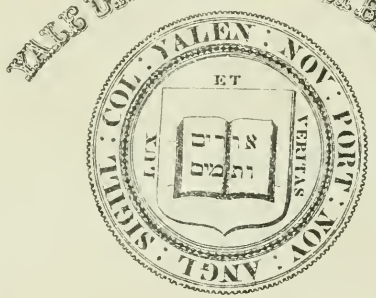

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ELEMENTS

OF

Medical Jurisprudence.

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OF

MEDICAL

JURISPRUDENCE.

BY

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CONTENTS.

CHAPTER I.

PERSONS FOUND DEAD.

CHAPTER II.

WOUNDS ON THE LIVING BODY.

CHAPTER III.

POISONS.

CHAPTER IV.

MINERAL POISONS.

CHAPTER V.

MINERAL POISONS (CONTINUED.)

CHAPTER VI.

VEGETABLE POISONS.

CHAPTER VII.

ANIMAL POISONS.

MEDICAL JURISPRUDENCE.

CHAPTER I.

PERSONS FOUND DEAD.

Duties of the office of coroner. Sketch of the causes which may produce sudden death, independent of murder—(*a*) internal disease—(*b*) an external, accidental cause—noxious gases—cold and hunger—lightning—(*c*) suicide. Importance of dissection in all suspected cases. 1. Directions for performing medico-legal dissection—examination of the head, spine, thorax, and abdomen. Distinction between natural appearances and the effects of violence—hæmorrhage—ecchymosis—congestions of blood—inflammation. The degree of putrefaction compatible with dissection. 2. Of PERSONS FOUND DEAD FROM NOXIOUS INHALATIONS. (*a*) Carbonic acid gas—modes in which it may be generated—symptoms—appearances on dissection. (*b*) Sulphuretted hydrogen gas—symptoms—appearances on dissection. 3. Of PERSONS FOUND HUNG. Modes in which death occurs from hanging—appearances on dissection. Whether the person found hung, has been suspended before or after death—whether the hanging is the result of suicide or homicide. Cases. 4. Of PERSONS FOUND STRANGLED. Whether this has been actually the cause of death. Cases. Appearances on dissection. Whether strangulation is possible as an act of suicide. 5. Of PERSONS FOUND DROWNED. Examination of the signs which distinguish death by submersion, from death previous to submersion. Estimate of the value of each. Cases. Whether the drowning was the effect of accident, suicide, or homicide 6. Of PERSONS FOUND SMOTHERED. 7. Of PERSONS FOUND DEAD FROM WOUNDS. Whether the wounds are the result of accident, suicide, or homicide. Cases. 8. Of PERSONS FOUND BURNT TO DEATH. Spontaneous combustion—cases of this. 9. Of PERSONS FOUND DEAD FROM HUNGER. Appearances on dissection.

Death, even when it is the consequence of disease, is often an unexpected event. But if an individual expire under his own roof, surrounded by friends and relatives, we are disposed to consider it as an ordinary dispensation of Providence, and one to which all of us are sooner or later doomed. The features of the case differ materially, when a person is found dead on the highway, on the banks of a river, or in a lonely place. Indeed, if he be discovered to have paid the

last debt of mortality, either in a sudden manner, or at a distance from his home, the laws of civilized society demand an investigation of the cause, and over this investigation, the officer called a Coroner, is appointed to preside.

It will readily be observed from the above remarks, that the office in question is an important one. The duty of the coroner extends to an examination of the circumstances connected with every case of sudden or suspicious death, and he is to make this with the aid of a jury, summoned by him for the purpose. Future proceedings are regulated by the verdict that they may pronounce.

"In many instances, the evidence of medical men is required. Sometimes, indeed, the facts are so clear, that no professional opinion can be wanted, *but whenever there is the least uncertainty*, such opinions should be taken, and for the most part a dissection must be made."

The importance of medical testimony in the cases now under consideration, will readily be appreciated. It may, and indeed frequently does, decide on the life of an individual; and some preliminary cautions respecting the conduct of the physician or surgeon, may hence with propriety be introduced in this place.

The first observation which I shall offer, is a caution to the examining physician, not to permit sudden prejudice to warp his mind. There is nothing more common among the populace, who crowd around the bodies of persons found dead, than to suspect that they have been murdered, and the idea, instead of being judiciously combatted, if untrue, is permitted to gain strength by repetition. Against charges of this nature, the physician should always be prepared, and never allow them to have any influence over him. He should proceed to the examination of the body with a mind free from prejudice. He should also recollect, that sudden death is not an uncommon event, and that those who, at one moment, we see before us in the full enjoyment of life, may, at the next, be cold and inani-

mate. The secret, operating causes of this change, may remain unknown to us, and we can perceive only its effects. In addition to this, there are many circumstances which may be the origin of the sudden decease, and to which the person affected has been for a time exposed, without any knowledge of their consequences. Of this nature, are the breathing of noxious gases, the use of improper aliments, or of unhealthy water. The passions also, if highly excited, or a purely accidental cause, may respectively have caused the sudden death. And, lastly, the destruction of life may have been caused by the person himself. All these *possible* circumstances should be recollected, and before a case of this kind is referred to a criminal court, on the decision of a physician, which is generally the case, he should feel perfectly convinced that death has not originated from one of the three following causes: 1. Some internal cause. 2. Some external, accidental cause; and 3. Suicide. On each of these a few observations will be necessary.

(a) The sudden rupture of an aneurism in one of the large cavities, frequently produces instant death. So also does the bursting of purulent cysts in one or other of the viscera. But in both these cases, there are generally premonitory symptoms which indicate danger, and indeed cannot have passed without notice. Apoplexy, however, is a disease which, in some instances, may be mistaken in its early symptoms, and may terminate fatally in situations which preclude any observation of the event. We should here attend to the conformation of the body—the large head, short neck, and plethoric frame: to the posture in which the person is found—the food he has lately eaten—and the ligatures that surround any part. What is termed serous apoplexy, sometimes leaves no traces of disease, and practitioners have hardly been enabled to suggest the cause of death. In this instance, however, if no suspicious appearances be present, there can of course be no mistake as to the cause. But in ordinary cases of apoplexy, an exami-

nation of the brain and stomach sufficiently developes the nature of the complaint, and it should be borne in mind, that the individual may, when seized, fall from a height, and thus bear the marks of external injury.

It is not necessary, nor indeed would it be practicable, to enumerate all the causes of sudden death belonging to this division of our subject. A stroke of the sun, a fit of violent anger, intemperance in the use of spirituous liquors, epilepsy, gout, and a variety of other agents, have produced the sudden extinction of life.*

(b) The external accidental causes which may produce sudden death, are, amongst others, the following : exposure to noxious gases—to cold and hunger—an immoderate use of spirituous liquors—the imprudent drinking of cold water when heated, and lightning.

The first of these is sometimes made an instrument of murder, and as such, I shall hereafter notice it. But at present, it may be observed, that accidents frequently occur from noxious inhalation, accompanied with circumstances that sufficiently indicate their cause. Such, for example, is the case when miners are found dead near the places where they worked—when a body is found near a lime kiln, or when life is suddenly destroyed on going into a well, or a cellar that has been long shut. The use of charcoal in close chambers, has proved fatal to many. The evidence in all these instances is sufficiently powerful to assign the cause to accident, unless the appearance of the body leads to a different opinion.

Death from exposure to cold, is not uncommon, and if it happen at a distance from towns or dwellings, is generally characterized by circumstances not to be mistaken. It may however occur in populous places, and it is then more liable to misconstruction and sus-

* Some remarkable cases of sudden death are mentioned by Mr. Chevalier, in the Medico-Chirug. Transactions, vol. I, p. 157. He denominates the disease *asphyxia idiopathica*. The heart, on dissection, was found flaccid, and all its cavities were entirely empty of blood.

picion. It is a ready conjecture that the sufferer has made an attempt on his own life, and in all such cases, marks of hunger will generally be found combined with the other appearances. Dissection must here also be the guide, and we shall hereafter indicate the points most worthy of attention.

The same remark applies to those who die from taking a quantity of spirituous liquors. The fluid here acts literally as a POISON, and it will be considered as such in a subsequent chapter. But there is a cause of sudden death, which is becoming quite frequent during our summers, and which is altogether accidental. I refer to the drinking of cold water, when the body is heated from exercise. The person whose imprudence instigates him to this, generally falls down dead in a few moments. It is not to be supposed that any great change from the state of health will be observed on dissection, and we must therefore rely principally on the history of the case. It is to be regretted that examinations *post mortem* have not been made morefrequently in these instances.

As to death by lightning, it may be remarked, that this is usually distinguished by a variety of appearances. Sometimes the viscera are destroyed, without any external mark being present, while in others there is nothing to be seen but a small hole. Again, there will be great external injury observed. But the most common accompaniments are discoloration of the skin, generally in the form of streaks. These are of a red colour, and it has been remarked, that they are peculiarly to be traced in the direction of the spine. "It is also said, that the bodies of persons killed in this manner are unusually flaccid, that the blood is found in a fluid state, and there have been inflammatory appearances internally." These however are not to be viewed as conclusive, since they are observed in death from other causes.* But if an individual be found in

* The bodies of those who are struck by lightning, are not always found flaccid. Dr. Francis mentions that he has seen a case where the muscles immediately became excessively rigid, and he refers to Beccaria for a similar example. New-York Med. and Phys. Journal, vol. 2, p. 21.

an open place, or under a tree, shortly after a thunder storm, with the ordinary appearances mentioned above, we may attribute his death to lightning, and particularly so, if the metallic substances about him are found melted and his clothes burnt or consumed, while the dissection exhibits nothing adverse to the idea.*

(c) Whether sudden death is caused by suicide or homicide, is often a most difficult question to determine. I shall here only allude to some general circumstances which require attention, and reserve the more minute examination for the respective sections of this chapter.

The moral history of the individual ought to be ascertained—his disposition of mind, and his worldly condition. It is a proper subject of enquiry, whether he has met with losses or disappointment; whether he has been solitary in his habits, and whether any of his family or connexions have an interest in his death. The season of the year should be noticed. Dissection also, should not be omitted. Morgagni observes that he found the brain of maniacs of an extraordinary hardness, and Durande and Fourcroy, have found in suicides associated to this state of the brain, an induration of the liver, with calculi in the gall bladder. The circumstances of each case deserve close and attentive examination, since each has its peculiarities.†

The importance of medico-legal dissection will be readily observed after a perusal of these preliminary observations. It is in fact the only sure guide for the physician, and the necessity of attending to it is in-

* Many cases of death or injury by lightning, together with the appearances observed, are to be found in the Philos. Trans. See vol. 1, p. 222, 247. Vol. 5, p. 2084. Vol. 19, p. 311. vol. 20, p. 5. Vol. 21, p. 51. Vol. 22, p. 577. Vol. 26, p. 137. Vol. 33, p. 366. Vol. 34, p. 118. Vol. 36, p. 444. vol. 48, p. 86. Vol. 51, p. 38. Vol. 52, p. 515. Vol. 62, p. 131. Vol. 63, p. 177 and 231. Vol. 66, p. 493. Vol. 71, p. 42. Vol. 77, p. 61 and 130. Vol. 80, p. 293. There is also an interesting account of the celebrated death of Richman at St. Petersburgh, vol. 49, p. 61.

† The general course of remark in these preliminary observations, is taken from Foderè, vol. 3, p. 1 to 14, and its similarity to sec. 1, chap. 2, of Smith's Med. Juris. will be readily observed by those who peruse the latter work.

culcated by every sentiment of professional pride, as well as by the feelings of common humanity. The medical examiner generally dictates the verdict of the coroner's jury, and it is but a sorry excuse, after a suspected individual has lain for months in a jail on the strength of his opinion, then to come before a court and say he drew wrong inferences from external appearances, or on the other hand, to meet a brother practitioner who invalidates his opinions, and demonstrates the crudeness and insufficiency of his investigations.

In further noticing this subject, I shall consider it under the following sections :

1. Of medico-legal dissection.
2. Of persons found dead from noxious inhalations.
3. Of persons found hung.
4. Of persons found strangled.
5. Of persons found drowned.
6. Of persons found smothered.
7. Of persons found dead from wounds.
8. Of persons found burnt to death.
9. Of persons found dead from hunger.

The subject of wounds generally, and of poisons, would probably, in perfect strictness, belong to the present title, but as they are very extensive and important in their nature, I prefer considering them in distinct chapters. This division will also allow us to consider their effects upon the living body.

1. *Of medico-legal dissection.*

Under this head, I shall give general rules for the examination of dead bodies, applicable to all cases where investigations are required. There are, however, some instructions particularly required in instances of supposed poisoning, which I shall postpone till we come to that chapter.

The manual published some years since on this subject, by Dr. Rose in Germany, and translated by Dr. Marc into French in 1808, is so complete and

excellent in its matter, that I shall copy from its pages with great freedom.*

Before proceeding to the dissection, it is proper first to examine the external situation and appearance of the body, and to facilitate the investigation, the following rules may be observed. 1. If the death be apparently caused by a wound, the body should be first viewed, if possible, exactly in the position in which it was found. By moving it, the attitude of the extremities may be altered, or the state of a fracture or a luxation changed, since the internal parts vary in their position with one another, according to the general position of the body. If it is absolutely necessary to remove it, it should be done with great caution. 2. The clothes should be removed, as far as is necessary, and it should be noted what compresses or bandages (if any) are applied to particular parts. 3. After these preliminaries, we must examine the colour of the skin, the temperature of the body, the rigidity or flexibility of the extremities, the state of the eyes, and of the sphincter muscles, noting at the same time whatever swelling, ecchymosis, wound, ulcer, contusion, fracture or luxation, may be present; also any fluid flowing from the nose, mouth, ears, sexual organs, &c. and indeed every thing varying from the natural state. The above cavities should be inspected, and particular attention must be paid to the state of the skin, so as not to mistake that bluish-brown tinge which indicates the commencement of putrefaction, for ecchymosis. The distinction between these we shall presently explain.

At this period, it may sometimes be necessary to delay the dissection for a few hours, and the wish of the examiner is of course to prevent putrefaction. To effect this, it has been recommended to put the body in a cool place, and cover it with ice, or it may be

* See the title in the list of works consulted. I must, however, remark, that the dissertation of Mauchartus *de inspectione et sectione legali*, resp. J. M. Sabner, published at Tubingen, 1736, and republished in Schlegel, vol. 1, p. 76, anticipates most of the directions that are given by Rose.

sprinkled with spirituous or aromatic substances. If it is intended to preserve it for some time, it should be washed with a strong solution of common salt and alum. The cadaverous smell present during the examination, may be obviated in a great degree, if the change be not too far advanced, by passing a current of chlorine, or the fumes of tobacco, through the chamber.

From the period when the dissector commences, until he concludes, there should be a clerk at hand taking down all the facts he may from time to time communicate, and this should not be delayed until the examination is completed, as many circumstances of importance may otherwise escape his memory.

If there be an external lesion present, it should first be examined, and its nature described—its length, breadth and depth—also whether it has been inflicted with a cutting, pointed, or round instrument—whether it is accompanied with inflammation or gangrene, and whether any foreign bodies are found in it, such as balls, or pieces of cloth. The scalpel should then be employed to trace its extent, but with judgment, so as not to render our researches useless, and to prevent a comparison of the external wound with the internal injury. The nerves and blood-vessels, and particularly the arteries that are wounded, should be named, as should also the viscera, if any are in that state. *If there be a contusion without a solution of continuity,* the injury found in the internal parts should be particularly noticed, such as extravasation, rupture of vessels, &c. *If the cause of death is a burn,* its degree and extent should be examined, together with the state of the parts affected, whether inflamed merely, or covered with blisters—the fluid contained in these blisters, and the condition of the neighbouring parts, whether sphacelated or gangrenous. *If a luxation or fracture be present,* notice the surrounding soft parts—the nature of the injury, whether simple or complicated, and the phænomena indicating the progress of disease or of recovery.

Having stated all these circumstances, it is next necessary to proceed to the dissection in a systematic manner, and the rule here is, to commence with an examination of the abdomen, as that part is most liable to run into putrefaction. We, however, should not desist because we suppose that the cause of death is perfectly discovered in one or the other cavity : all of them should be investigated.

On viewing the head, the integuments are to be inspected, and all injuries done to them are to be noticed. In particular, if a wound appear to be inflicted by a sharp-pointed instrument, its depth, direction, and connection with the brain, should be minutely traced. The presence of inflammation, œdema, or sphacelus, must also be remarked. The same observations apply to injuries from cutting instruments. The bones of the cranium are next to be laid bare—search is to be made if there be no fissures or fractures, taking care at the same time not to mistake irregular sutures for them ; and for this purpose, they should be rubbed over with ink. The strength of these bones is also deserving of minute inspection, as they not unfrequently are so thin or soft as to render a blow very destructive, but which under ordinary circumstances would only produce slight injury. The fracture should always be followed throughout its whole extent.

The membranes and the brain must be carefully inspected. Let it be noticed whether any pus or blood is interposed between the dura mater and the bones, or whether it is detached or inflamed. All morbid appearances in structure deserve attention, and the state of the vessels of the brain, the fluids present, and their situation, together with the changes in the substance, are highly deserving of attention. It should, however, be remembered, that death sometimes follows from blows on the head, when no internal lesion can be found on dissection. It has been abundantly proved, that the connexion between the brain and the viscera of the thorax and abdomen are

the cause of this, and the injury is therefore to be looked for in the latter.

The vertebral column must be viewed throughout its whole extent, as to its being fractured, or dislocated, or contused. This part requires strict attention, since injuries of it are often of a very complicated nature. Fodere quotes a case from Jaeger, of a person who was struck on the neck, by a loaded waggon, with such violence that both his upper and lower extremities became paralytic. He died in eighteen hours after the accident. No external appearances of injury could be observed, although an examination readily indicated that the seat of disease was somewhere near the sixth cervical vertebra, and accordingly, on dissection, its spinous apophysis was found broken at its base, and separated from its body, while blood was extravasated to the amount of four ounces.

We should inquire carefully whether the neck bears any marks of external injury, or traces of ecchymosis, or pressure on it. Examine the great blood-vessels, whether they are filled with blood, or empty—and the nerves, whether they are in their natural state. The œsophagus, pharynx, and larynx, must be noticed. If wounded, detail the extent, depth, and shape of the injury, and particularly if the lesion is caused by fire-arms—its course, and the loss of substance present, together with the inflammation or suppuration (if any) existing, should be stated.

On proceeding to the thorax, it should first be ascertained whether the injuries it has received, are superficial, affecting the integuments and muscles merely, or whether they extend to its cavity. If the latter, the following are subjects worthy of observation. The blood-vessels—the bones covering the thoracic viscera, enquire whether any of these are fractured, luxated, or diseased. Next, as to the respective organs—notice the lungs, and their internal, as well as external condition—the pericardium and its contents—the heart and its great vessels—the diaphragm—the thoracic duct, and the phrenic nerves;

all injuries or diseases of these should be stated in the report.

Lastly, as to the abdominal cavity. Its external covering forms a subject of enquiry. Every spot, swelling, or extravasation, should be noticed, as also whether hernia be present, or whether there is any tumefaction of the part. The organs peculiar to either sex, should be examined, and also the various viscera contained in this cavity—the stomach, mesentery, liver, spleen, gall-bladder, intestines, bladder, &c. &c. We should view each part as to the quantity of blood which naturally belongs to it—trace all extravasations as to their quantity and nature, and particularly enquire whether the changes observed are the result of disease, or of sudden injury. Professor Mahon recommends the use of a blunt pointed bistoury in examining the intestines, as this may prevent injury during the dissection. The contents of the stomach and intestines should be analyzed, and those of the gall-bladder and urinary bladder inspected.

All wounds should be probed cautiously, so as not to produce greater injury than is already present, and the blood that is extravasated in a cavity, should be carefully removed, before a new dissection is commenced. In this way, the quantity appertaining to each can best be ascertained. If any of the viscera seem to require a more strict investigation, they may be removed from the body after the general dissection.

From this enumeration, it will readily be seen how necessary an accurate knowledge of anatomy is in such cases, so as not to mistake the appearances which are naturally found for extraordinary occurrences, or the effects of disease for those of violence.

Having completed the dissection, the notes should be taken and reduced to order, and in preparing the report, or in giving testimony, it should be as simple and plain as possible, avoiding all those terms which are unintelligible to a court and jury.*

* The most valuable writings on medico-legal dissection, are Marc as already stated, p. 1 to 54 Mahon, vol. 2, p. 217 to 257. *Ouverture des Cu.*

While forming an opinion, the physician must recollect, that there are certain phenomena observed on the bodies of the dead, which may be mistaken for the effects of violence, and yet are only the consequence of previous maladies. Again, there are others which are the result of the extinction of life, while by the vulgar, they are deemed proofs of murder. A notice of these may be useful, in order to establish the distinction between violence exercised on the living or the dead body. I shall mention the following: Hæmorrhages, ecchymosis, congestions of blood, inflammation, and marks of severe suffering.

Hæmorrhage is supposed by many to indicate an existence of the circulation when it commenced, and accordingly they consider it *prima facie* evidence, that life was present when the supposed violence was offered. On this, however, it may be remarked, that if such a rule be laid down as universally true, it will lead to dangerous errors. It is frequently observed by anatomists on opening the bodies of those dead from apoplexy, or malignant fever, that blood flows from the mouth, nose or ears. The blood in these instances is of a black colour, and apparently more fluid than in its natural state. Hæmorrhage, then, if observed on the dead body, is of itself no proof that a lesion was inflicted on the living one, and in order to warrant an opinion of this kind, the large vessels should be found empty, and the blood of a florid red colour.

Ecchymosis, contusion, sugillation, and various coloured spots on the skin, are also appearances that may occasionally lead to error. It is important that the distinction between these terms should be properly understood, and the following observations from Belloc are therefore worthy of remembrance. The term

davres, and Foderè, vol. 3, chap. 1, sect. 1. Some valuable remarks may also be found in Dease's Remarks on Medical Jurisprudence. It will be understood that every species of violent death, requires an investigation in some degree peculiar to itself, and the minutiæ of this will be noticed under each section. I have only thus far laid down general rules, and postponed the rest to prevent repetition.

contusion, is derived from the Latin word contundere, to bruise or pound, and hence conveys a similar meaning. *Ecchymosis* is a Greek term, and is equivalent to effusion, or spreading of blood into the cellular tissue. It is present whenever the contusion is sufficiently violent to produce the rupture of a blood vessel, and it communicates a colour more or less livid to the skin.

Contusion may then exist without ecchymosis, but the latter is always the consequence of the former, and both originate from some external cause. Ecchymosis differs from *Thrombus* in being less circumscribed, and possessing the characteristics of a tumour in a less distinct degree.

Sugillation is also an effusion of blood into the cellular membrane, resembling at first view an ecchymosis, but it originates from internal causes, such as the commencement of the putrefactive process, and hence often occurs in the living body. The livid, dark coloured spots, which under the above circumstances, are often seen, belong to this division, and they must be familiar to those who view the bodies of persons dying from malignant fevers, scurvy, &c.*

It will readily be remarked, how important an accurate distinction between ecchymosis and sugillation must become, in doubtful cases. Zacchias has suggested the following: when this discoloration is the consequence of external violence, a congestion of thick *concrete* blood will be found, but in the spontaneous spot or sugillation, the blood on incision, will be seen *fluid*. There is probably considerable truth in this, although observers have not, in all cases, proved the difference. Stoll, of Vienna, examined the bodies of two females, who died of petechial fever, and observed spots which extended to a considerable depth, and contained a large quantity of extravasated blood. They had all the appearance, he adds, of being caused by external injury.†.

* Belloc, p. 315, 316. † Mahon, vol. 2, p. 210, 211.

Belloc relates an instructive case which came within his own observation. During the prevalence of an epidemic small pox, a husband, maltreated his wife, who was five months advanced in pregnancy. He gave her several kicks on the thighs and abdomen. A week afterwards, she was seized with the small pox, and died in a fortnight after the injury, covered with dark coloured spots, and also with marks of the disease. In this condition she was buried, but her relatives hearing of the ill treatment she had received, complained of the husband, and the body was accordingly disinterred and examined by physicians. They decided both from the symptoms present during her illness, such as violent hæmorrhage from the nose, and from the appearances observed on the bodies dead from this epidemic, that the cause of death was the small pox, and that the sugillations were the consequences of its malignity.*

I should not recommend an implicit dependence in the test of Zacchias, although it certainly deserves attention. When sugillation is supposed to be present, it should be particularly noticed whether it appears on a depending part. The time that has elapsed since the death of the subject, and the prevalence or absence of putrid epidemics, also require consideration. On one point, however, we should place a strong reliance, and that is, when marks of this kind leave a distinct impression of the instrument of murder. Thus on a person hung, an ecchymosis marking the course of a rope, is a certain proof, and again, similar marks of cords on the extremities indicate most conclusively that these injuries have not been inflicted on a dead body.†

* Belloc, p. 317, 318.

† Marc, p. 11. See also Bose *de sugillatione in foro cautè dijudicanda*, in Schlegel, vol. 4, p. 67. The following case may be read with profit by all medical men. John Stringer was tried at the Lent assizes, held at Kingston in the county of Surry, in the year 1765, before the late Chief Baron Smythe, for the murder of his wife, and found guilty. It appeared that they had frequently quarrelled, and *a young surgeon gave it as his opinion, that some appearances in the corpse were somewhat the appearances of a mortification occasioned by bruises.* Mr. Carsan, an eminent surgeon in the

Congestions of blood in the viscera are often found after death in persons who have been subject to disease. In such cases, the vigour of the circulating system and the action of the nervous one, are illustrative of the truth, since on dissection, if violence has been used, they bear the mark of having occurred recently, and they are also particularly noticed in the head and lungs, while in ordinary cases, they are more extensively diffused. It should also be remembered that blood is sometimes found extravasated in one or more of the large cavities, and is to be considered as a natural appearance unless we find some of the blood vessels injured. Foderè quotes a remark of Vicq D'Azyr, respecting the presence of several drops of blood being almost always observed by him on dissection in the *torcular herophili*, and that great anatomist attributes this to the position in which the head is usually placed after death. The blood goes to the depending part.*

Wounds received before death, are marked by red, bloody and separated edges. Those inflicted afterwards, are livid, and their edges close to each other. Similar appearances characterise contusions or blows in which there has been no solution of continuity, and on dissection they are, if inflicted on the living, found to be sub-cutaneous wounds: vessels are seen torn and fluids extravasated, and the whole exhibits the marks of tumour in its elasticity and circumscribed shape.

neighbourhood, had, on the report of the murder, from mere curiosity, examined the body, and was so clear that there were no marks of violence thereon, that he had not the least apprehension of the possibility of Stringer's being convicted; but hearing of it, he stated the case to the Archbishop of Canterbury, obtained a respite from Baron Smythe, and finally was the means of obtaining a complete pardon from the King. Phillips' Law of Evidence, Appendix, p. 105.

* Foderè, vol. 3, p. 30. In hot climates, or even in the hot season of the year, it must be remembered, that the changes are most rapid. Dr. John Davy mentions a fact observed by him in Ceylon, which deserves attention. If the interval between death and the examination of the body was twenty or thirty hours, the serous and mucuous membranes appeared red and inflamed, and particularly those parts which are most exposed to the action of the blood, as the valves, and the lining membrane of the heart and blood-vessels. The viscera also appear dark and livid. He attributes this to the exudation of bloody serum, which tinges the parts in such a manner as to exhibit the appearance of real inflammation. Medico-Chirurg. Transactions, vol. 10, p. 89.

Violence to the dead body can only produce livid flaccid spots, unattended with engorgement or tumour. Gangrene also is marked by its being surrounded with a red edge: putrefaction is not, and the spots caused by the latter are of various colours. Dry gangrene cannot take place on the dead body, since there is no heat, or action of vessels to produce it, but the disorganization observed, is of a humid nature.

There are circumstances, however, which invalidate the importance of this sign, and render it somewhat doubtful. Thus for example, a man may die of a wound, before inflammation commences. Others are so debilitated, that wounds on them have livid and dry edges, and after death, can scarcely be distinguished from those inflicted on the dead. These circumstances should be kept in mind.

The signs which seem to indicate *pain* or *spasms*, should be observed, but never greatly depended upon, since a natural death is often preceded by them.*

The following case may serve as a useful corollary to the observations contained in this section.

The widow Montbailly of St. Omers, aged sixty, and of a very gross habit, was much addicted to intoxication, and in fact was inebriated daily. On the 27th of July, 1770, at 7, A. M. she was found dead in her chamber, laying on a trunk which had sharp edges. A physician and surgeon visited the body on the next day, (thirty-two hours after her death had been discovered,) and reported that they found ecchymosis and contusions on the arms, thorax, and particularly over the third, fourth, and fifth ribs. The neck and upper part of the breast were also ecchymosed. The head was swelled—blood was extravasated under the skin of the face, and the nose was filled with clotted blood. On the eyelid there was a wound of nine or ten lines in extent, which penetrated to the orbit, and which might have been caused by a sharp or cutting instrument, but could not, in

* On these equivocal signs, see Mahon, vol. 2, p. 200 to 217, *Mort Violente;* and also Foderè, *Loco Citato.*

their opinion, have produced sudden death. On opening the body, all the internal parts were found in a natural state.

The reporters gave it as their opinion, that the ecchymosis, the swelling of the head, and the extravasated blood, were occasioned either by a fall, or by blows from an opposing body, and that the female had died either from the hæmorrhage occasioned by the wound, or from suffocation.

A physician who from curiosity had attended the examination, but who was not of the commission, stated that the eye was ecchymosed, and that the edges of the wound were irregular and indented.

On combining the result of this inspection, with the fact that the defunct had formerly repeated quarrels with her son and daughter-in-law, it became the prevailing opinion that they had murdered her. The superior court of Arras, before whom the cause was tried, condemned Monthailly and his wife to be broken on the wheel, and it was actually executed upon him. The wife claimed a delay on account of her pregnancy, which was granted. During this interval, a revision of the trial was procured, and the celebrated Louis was consulted, as to the point whether the facts stated proved that the woman had been assassinated. The result of his investigation was, that there was no certain proof of the commission of murder, and that all the circumstances enumerated were stronger proofs of the individual having died from apoplexy, than from any other cause. The following are some of his reasonings and remarks:

Intemperance predisposes to sanguineous apoplexy, and the reporters have neglected their duty in not opening the head of the deceased, since by doing so, the condition of the internal parts would have explained the cause of the hæmorrhage. Again, a person in a state of intoxication, and predisposed to this complaint, would on falling against any sharp edged substance, naturally lose a considerable quantity of blood, and also have the arteries and veins of the

head much distended. He totally discards the idea that the hæmorrhage from the wound of the eye was a cause of death.

As to the ecchymosis, or livid spots, found on the thorax and arms of the deceased, and which the reporters attributed to blows or falls, M. Louis observes, that they are the ordinary appearances found on those who die in a state of intoxication, and among others, quotes the following case in confirmation, from Morgagni. A beggar went to bed drunk, and died suddenly during the night. This was at the end of January, 1746. On the next evening he was carried to the anatomical hall in Padua, and on the third day after his death he was dissected. Morgagni found the body still warm. The scrotum was ecchymosed, of a red colour, the face filled with blood, not only under the skin, but all the muscles, the membrane that separated them and the glands, appeared engorged. Louis remarks, that these spots should have been particularly examined, in order to have founded any charge upon them.

It appeared further, that the body was examined at the end of the month of July. Might there not have been some incipient putrefaction present, and would not this account for the swelling of the head, the lividness of the thorax, and other similar symptoms? As to the wound in the eye, the reporters themselves leave its effect uncertain, while the cause might have been accidental.

On these grounds, Louis gave it as his opinion, that the report was inconclusive, and that there were no proofs of assassination. The superior court of Arras accordingly, in 1772, revoked their decision, exonerated the memory of Montbailly, and enjoined the physicians and surgeons thereafter to extend the examinations to every part of the bodies of those found dead, and also to state in their reports the scientific reasons for all opinions they might give.*

* Foderè, vol. 3, p. 64, from the *Causes Celèbres*. See also, at page 98, a similar case from the same. *Cause de Chassagnieux*.

It will form a proper conclusion to this section, to notice what degree of putrefaction is compatible with a proper dissection. This question often arises when bodies are disinterred for examination, and on trials, it is also a fruitful source of discussion.

Putrefaction commences gradually when the vital principle is extinguished, and after a certain period, which, however, differs in different bodies, according to the previous diseases, the season of the year, its temperature, &c. it produces an extensive disorganization, confounding the cause of death, and rendering it dangerous for any one to examine the body. In such cases, it is evidently not the duty of the physician or surgeon to risk his life. Louis the 15th of France, died from small pox, and his body was purple and gangrenous with the disease. The chamberlain desired, that according to etiquette, La Martiniere, the first surgeon to the king, should open the body. This last, being aware of the danger, observed that he would perform his part, provided the chamberlain, according to the same etiquette, was present, and held the head of the deceased during the operation. He warned him, however, at the same time, that he could not answer for his life, if it was done. The chamberlain spoke no more of it, and the king was interred without any dissection.* I mention this anecdote for the benefit of those who may be improperly urged by magistrates.

After a certain period then, it will be impossible to form a correct judgment on the state of the soft parts, nor ought any investigation to be permitted, since it can only lead to conjecture. There is however an exception, and that is, when wounds have been inflicted by fire arms, or by an instrument which leaves them of a considerable size. The traces of these are generally so very distinct, as to be judged of on bodies, for a considerable period after death. The blows of an axe, says Foderè, were very visible in one case,

* Belloc, p. 321.

where the body had been buried thirty days. This subject however retained a more than ordinary degree of freshness.

This difficulty respecting the soft parts is of course obviated, when we examine the hard parts. A fracture may be as distinctly observed and is as good proof, two months after death as one day, and this notwithstanding the putrefaction that may be present. A dead body was found in the field, in the *arrondissement* of Trevoux, during the month of May 1811. The surgeon, deterred by the putrefactive smell, reported generally that he had discovered no marks of violence. Meanwhile, some ditchers, on interring the body, remarked that, *on the fall of a handkerchief which covered the head,* the bones of the cranium detached themselves, and the brain issued out. The imperial attorney immediately ordered a special examination of the head, and it was found that this person had received three blows from a cutting instrument, which separated the parietal bones from the skull. The assassins, after committing the crime, had replaced them and secured them with a handkerchief bound very tight. They were afterwards discovered and punished.*

Many circumstances develope or delay the progress of putrefaction. Heat, humidity and the contact of air accelerate it, and it is always most rapid, when from the presence of a typhoid disease, it appears to commence before life is extinguished. Interment delays putrefaction, and some species of earth, more than others. Taking these facts into consideration, it will be found useful to attend to the following statement of the progress of putrefaction, and the comparative utility of dissection in each. It has been proposed by Dr. Boissieu.

First degree. A tendency to putrefaction. It consists in a slight alteration of the body, a softness of the flesh, and a disagreeable odour. *Dissection is practicable and still useful.* And here let me remark,

* Foderè, vol. 3, p. 72.

that all appearances, even those which are deemed certainly indicative of putrefaction, should be stated. They may prove the foundation of useful deductions.*

Second degree. Commencing putrefaction. A fœtid odour is present, the fleshy parts become light and assume a dark colour. *Dissection is already dangerous, and can be of no use except in particular cases.*

Third degree. Advanced putrefaction. The parts exhale an ammoniacal odour mixed with a putrid smell. They fall into dissolution, and their colour is constantly altering. *Dissection is impracticable and useless.*

Fourth degree. Complete putrefaction. This is known by the complete dissipation of the ammoniacal odour, and also by the putrid smell loosing its strength. The volume and weight of the parts is much diminished, and they separate into a gelatinous mucus, which gradually dries, and at last becomes an earthy and friable mass.†

A consultation by the celebrated Petit, will form a commentary on the subject now concluded.

A young man aged twenty, who a short time previous, had passed through a mercurial course, amused himself during the whole day, of the 25th November, 1774, on the ice. In the evening, although in a state of perspiration, he put his naked legs and thighs in the snow and remained there half an hour. He retired to bed as usual, and in the morning was found dead. The burial took place without any formalities. Ten months after, on a suspicion that he had been murdered, the body was disinterred and examined. On opening the thorax, a large quantity of blood was found in the left side, between the pleura and the ribs, and corresponding to it externally, there was an extensive appearance of contusion. The question was put to Petit, whether this indicated that a blow had been inflicted. He answered in the negative and

* Marc, note to p. 4.

† Foderè, vol. 3, p. 73, 74.

observed, that during thirty years experience, he had always observed these ecchymoses to occur on the commencement of putrefaction—that the epidermis gradually separated from the skin, and on opening the latter, a greater or less extravasation was found. This state was particularly to be expected in a young man, who died suddenly, and full of blood. The length of time that had elapsed, the consequent uncertainty of the proofs, and the danger of the dissection, are also adverted to by him. In consequence of this opinion, the suspected persons were liberated.*

2. *Of persons found dead from noxious inhalations.*

A vast proportion of the gases, discovered by modern chemists, are irrespirable. Few of them, however, are spontaneously generated, and their noxious power must of necessity be extremely circumscribed. We shall notice such as have proved destructive to life, under the head of poisons. But there are some which may be produced under ordinary circumstances, or are occasionally the results and accompaniments of peculiar situations and occupations ; and of these, none is more deleterious than CARBONIC ACID GAS. This substance may be generated in various ways. 1. When a number of persons have remained during a long time in an apartment, or any other place where the air is not renewed. They mutually vitiate the air, and produce, by the process of respiration,

* Foderè, vol. 3, p. 75 to 79. There are some English law cases which deserve mention, with reference to the present subject. "A man hanged himself, and the jury found him possessed of a messuage, which as a *felo de se*, he forfeited. *Pengelly*, Sergeant, moved to stay the filing of this inquisition, upon an affidavit that the man died five years before, and the coroner dug up a skull, which he knew by a particular mark was the deceased's and thereupon the inquisition was taken, which he insisted ought to have been upon view of the whole body, that the marks, if any, may appear. *Court.* Stay the filing till further notice." (The King v. Bound. Strange's Reports, vol. 1, p. 22.) In another case, (Queen v. Clerk,) where an inquisition had been quashed, though the body had lain buried for seven months, the coroner took it up, and had another inquisition found. This was complained of. HOLT, Chief Justice, said, "The body may be dug up again, but it ought to be upon fresh pursuit, and not at such a distance of time ; *for it is a nuisance, and may infect people.*" Salkeld, p. 377.

the poison in question. The most striking and melancholy instance of this occurred at Calcutta, in 1756. When that place surrendered to Shujah Dowla, he thrust one hundred and forty-six Englishmen into the *black hole*, at Fort William, a place only eighteen feet by fourteen, and having only two apertures through which air could be admitted. They remained here from eight in the evening, until the next morning, when only twenty were alive. A somewhat similar instance happened in London, in 1742. Twenty persons were forced into a part of St. Martin's round house, called the *hole*, during the night, and in consequence, several died. The surgeons on this occasion gave it as their opinion, that when the doors and windows were shut, the place could not support twenty persons without danger of their lives.* Individuals, in a state of suffocation from this cause, are seized with an unsupportable thirst. A copious perspiration is present, and great pain in the chest, difficult respiration, and intense fever follow. They lose their strength, and fall into a deep lethargy, to which death soon succeeds, if aid be not speedily given.† 2. The fumes of burning charcoal, consist principally of this substance and carbonic oxide. This is unfortunately a frequent cause of death. Persons on going to bed, leave pans of it burning in their apartments, and in the morning are found lifeless.‡ 3. Carbonic acid gas is contained in the exhalations from lime kilns,‖ and cellars, where wine, beer, or other liquors are in a state of fermentation. Hence the danger of sleeping near the former, and the necessity of ventilating the latter. 4. This gas is frequently produced

* Smith, p. 206.

† Orfila's Directions, p. 170.

‡ A large number of cases of this description is quoted by Dr. Dobson, in an essay contained in Percival, vol. 1, p. 328. See also Phil. Transactions, vol. 52, p. 454.

‖ "June 19, 1813. This morning, two lads were found senseless on a brick-kiln in St. George's Fields. The eldest was recovered by medical assistance, but the other was lifeless. It is supposed that they had resorted to the kiln for the sake of warmth, and having fallen asleep, were suffocated by its fumes." Edinburgh Ann. Register, vol. 6, part 2, p. 64.

in wells, marshes, and mines. In the latter, however, a different substance is also generated, called the *fire-damp*, or carburetted hydrogen gas, which is no less deadly. But the frequency of fatal accidents to persons descending wells, is to be ascribed to carbonic acid.*

"Persons affected by this agent, feel a great heaviness or pain in the head, intolerable singing in the ears, a great disposition to sleep, and so great a loss of strength as to be unable to support themselves upright, great difficulty of breathing, and violent palpitation of the heart, followed by a suspension of the respiration and circulation. The senses no longer exercise their functions, and sensibility appears to be extinct.†

If they are discovered, after the gas has had its full operation, their bodies present the following appearances: the head, face and neck are swollen; the eyes are propelled from their sockets, but preserve their brilliancy often for two or three hours after death; the tongue is protruded, swollen, and inclined to one side of the mouth; the jaws are firmly closed; the face is livid; the lips are of a dark blue colour; the abdomen is inflated; the body preserves its warmth for a length of time, and sometimes indeed is warmer than natural, while the limbs remain flexible for some hours.‡

It will be understood, that in some cases all of these appearances are not present, although the majority generally are. Much depends on the temperament

* I will add to these the following curious case. On the 12th of May, 1650, some forgemen at Leipsic were drinking in a chamber, where a child, twelve years old, was asleep. They amused themselves with passing a half extinguished candle under its nose. The child awoke, but again fell asleep, and they continued this course for half an hour. It was shortly after seized with convulsions, or epileptic fits, and died in three days after. The parents complained of this to the magistrates, who consulted the Faculty of Medicine. They answered, that the fumes of a candle were identical with the vapours from charcoal and lime, and would produce the same deleterious effects. Valentini's Pandects, vol. I, p. 195.

† Orfila's Directions, p. 160.

‡ Struve, p. 52. Belloc, p. 184, 185. See also the history of three cases by Dr. King, in the Edin. Med. and Surg. Journal, vol 7, p. 180. He remarks, that the fingers and toes were curved, and the nostrils dilated.

of the individual, and hence the face is occasionally of a pale colour.

As respiration has been interrupted by this agent, the passage of the blood through the lungs is impeded, and consequently its transmission from the right to the left side of the heart. We find, accordingly, on dissection, that the blood vessels, and particularly those of the head and lungs, are filled with blood, and this fluid is principally accumulated in the right side of the heart, and in the veins leading to it. The blood itself is black, and so fluid, that it is discharged readily from the smallest incision. Effusions of serum, tinged with blood, are found, particularly in the ventricles of the brain, and in the bronchiæ, while the muscles are so soft, as to be torn by the slightest exertion. The epiglottis is always elevated.*

The peculiar appearances which I have described, are important guides in determining the cause of death. Dissection should never be omitted in a case where there is the least uncertainty of its being an accident. The loss of irritability in the muscles is strikingly greater from this cause of death, than is ever seen in cases from drowning, hanging, &c. and it is therefore worthy of particular attention. We should also notice whether no marks of injuries are present, which may excite doubt. The place, the circumstances under which the body is found, the noxious material that has been inhaled, all deserve investigation, and may lead to the truth.

Asphyxia also occasionally happens from inspiring the exhalations of privies and common sewers. The noxious substance in this instance, is SULPHURETTED HYDROGEN GAS ; and this, even when mixed with a large quantity of atmospheric air, is a very powerful poison.†

* Portal, in Medical Commentaries, vol. 3, p. 254. Belloc, p. 184. Dr. Babington's case of exposure to the vapour of burning charcoal, in Medico-Chirurg. Transactions, vol. 1, p. 93. Orfila, vol. 2, p. 347. Larrey, vol. 2, p. 128.

† According to Thenard and Dupuytren, it is sufficient that the air contains 1-1300th of sulphuretted hydrogen, in order to kill a bird in a very

"When the exposure has lasted but a short time, the sufferer experiences a general uneasiness, accompanied with nausea and sickness; his respiration becomes irregular, but not difficult, and his pulse much agitated; the skin is cold, general convulsions take place, and the muscles of the chest and face are particularly affected.

In cases where an individual has been long exposed to the action of this gas, all power of motion and sensation is lost; a frothy saliva, tinged with blood, flows from the mouth; the lips and face are livid, the eyes are shut, and void of all brilliancy; the pupil fixed and dilated; the pulse is small and frequent, and the respiration short and difficult, and apparently convulsive; the action of the heart becomes disordered and violent, and the extremities are in a state of relaxation. To this succeeds an agitation more or less excessive, the muscles are attacked by alternate spasms and convulsions, and the body is curved backwards, while the individual appears to suffer from acute pain."*

In one case where death followed, and dissection was performed forty hours after death, the head and trunk were already putrid, the skin bluish, and elevated by gas. The blood contained in the various cavities was black and fluid. The brain was greenish and tender. The bronchiæ were of a red colour, and the posterior part of the lungs were gorged with black blood, but that organ was generally crepitous. The stomach presented traces of a recent irritation, and the internal canal was greenish. The liver, of a greenish black colour, was in a state of congestion. All the viscera exhaled the smell of putrid fish, and several of the persons present at the dissection, were subsequently affected with lassitude and stupor, sleep-

little time; that which contains 1-800th, produces death in a dog of middle size, and a horse dies in an atmosphere containing 1-250th part of it. Orfila, vol. 2, p. 371.

* Orfila's Directions, p. 167, 168.

lessness, and violent cholic.* Experiments on animals have presented similar results.†

3. *Of persons found hung.*

We understand by the term *hanging*, the suspension of a person by a cord, or some other ligature round the neck. The rapidity of death from it depends much on the manner in which the cord is adjusted—the texture and strength of the intervertebral ligaments—the fulness of the blood-vessels, and the strength of their coats. All these circumstances, together with that of the weight of the body, will render a shorter or longer space of time necessary to destroy life. Thus, for example, he will survive the longest, whose organs are of a firmer texture, whose vessels contain but little fluid, whose neck is long, and whose body is meagre.

It seems now to be well ascertained, that death from this cause may occur in one of two ways. The first has generally been deemed a species of apoplexy, produced by pressure on the large blood-vessels that go to the head. The circumstance, however, that actually takes place, is a deep sleep, arising from the cerebral compression, unaccompanied with the symptoms that attend apoplexy, and in no case of recovery, followed by the ordinary termination of that disease, viz. paralysis.‡ Fodere has collected some curious cases in illustration of this. Wepfer mentions an instance of a man and woman who survived hanging. The latter recollected nothing, and the former stated, that on the application of the cord, he felt no pain, but sunk as it were into a profound sleep. Morgagni also mentions, that an individual who recovered under similar circumstances, informed him, that the first sensation was flashes of light before his eyes, and

* New-England Journal, vol. 8, p. 279. Account of three cases extracted from the Nouveau Journal de Medicine, for April, 1818.

† Orfila, vol. 2, p. 374.

‡ See "a case of suspended animation by hanging, by Robt. John Thornton, M.D." &c. in the Lon. Med. and Phys. Journal, vol. 16, p. 529

that he then sunk into the same sleep. Our author also quotes a case on the authority of Lord Chancellor Bacon. A gentleman took a fancy to ascertain whether those who were hung experienced any pain, and actually performed the experiment on himself. He immediately lost all consciousness, and the event would have been tragic, had not a friend entered in time to cut him down.*

In these, and other cases on record, there does not appear to have been any of that convulsive state which generally accompanies apoplexy in a greater or less degree, nor in any instances were they succeeded by paralysis. It hence seems most probable, that asphyxia precedes death, which, however, will most certainly follow, if aid be not afforded. The compression interrupts the circulation between the head and the large blood-vessels proceeding from the heart, but it cannot prevent the circulation of the intervertebral veins and arteries, and death of course is not an immediate consequence of suspension, at least if no other fatal cause be interposed. The immediate cause of the stoppage of respiration, is undoubtedly the pressure on the nerves which are subordinate to that function.

It will, therefore, be more accordant to facts to say, that the first cause of death is an interruption, and then a cessation of the nervous action, and of course of respiration and circulation. There are still individuals, says Foderè, living in Marseilles, who, during the French revolution, were hung, and their lives saved in the night time, and who for a long period were affected with a ringing of the ears, and a species of deafness, indicating in a satisfactory manner that a lesion of the nervous action had taken place.†

The phænomena that present themselves on inspecting the bodies of those who die from hanging in this way, are the following : the mark of the cord is evident around the neck, forming a livid, depressed

* Foderè, vol. 3, p. 134–5. † Ibid. p. 140.

circle—the face, chest, shoulders, arms and hands, are swelled and livid, and often a bloody mucus issues from the mouth and nose*—the countenance is distorted—the eyelids generally open, and the eyes red and projecting——the tongue is occasionally wounded by the convulsive motions of the jaws, and frequently thrust out of the mouth†—the shoulders are raised, and ecchymosis is observed upon them, extending upon the breast, and down the arms—the fingers are bent, and the hand nearly closed.

The second cause of death from hanging, is one for which there is no relief. It consists, in addition to the compression, in a laceration of the trachea or larynx, or a luxation or fracture of the cervical vertebræ, occasioned by a rupture of the ligaments of the neck. The celebrated Louis enquired of several executioners, how they saved the lives of some criminals, while others were irrecoverably dead? They answered, that they caused, in the latter case, a laceration of the trachea, and luxation of the first cervical vertebra from the second, by placing the knot of the cord under the neck, and then giving a rotatory motion to the body at the moment when the ladder was taken from under his feet.‡ This luxation chiefly occurs in heavy persons, or where they may have fallen from a height upon the end of the rope, or where attempts have been made to hasten death by increasing the weight of the body. So violent also is this sort of death, that the fæces, urine, and even the semen, are often expelled.‖ And the rapidity of the extinction of life is well illustrated by the result, in cases where the vertebræ are injured.

Dissection is of course indispensable in every case that may come before a criminal court. The neck

* De Haen, vol. 4, p. 338.

† Dr. Smith remarks on this sign, that it is only produced when the rope presses upon the cricoid cartilage; when it presses above the thyroid gland, the tongue will be pushed back, owing to the compression of the os hyoides. Smith, p. 217. See also Belloc, p. 170.

‡ Foderè, vol. 3, p. 141. Dorsey's Surgery, vol. 1, p. 207.

‖ Male, p. 233. Smith, p. 217.

should be carefully examined—all external marks and internal injuries noticed, and in particular the condition of the cartilages. The principal vessels of the neck and head are generally filled with blood, and the latter *sometimes* ruptured, and we should observe whether there is any extraordinary fulness below the mark of the cord. The lungs are usually livid, and its vessels, together with the right side of the heart, are full of blood. The pulmonary cells are distended, and do not collapse when the chest is opened.

I must not, however, omit to remark, that occasionally the countenance of persons hung remains pale, and bears but few external marks of cerebral compression. The suddenness of death may probably explain these rare appearances.*

The medical witness may be asked two questions with respect to this subject, which it behooves him to investigate.

I. *Whether the person found suspended was hung before or after death?* or has he been previously killed in some other way, and then placed in this situation, to avert suspicion.

This question may be generally answered by referring to the data already laid down. When the person has been hung alive, the discolorations produced by the rope are very distinct, and pass all around the neck. The impression also will be of a red colour, and accompanied by that suffusion of countenance which we have already mentioned. On the contrary,

* I add the following circumstance in this place, merely as a historic curiosity. "March 16, 1814. On opening a vault at St. Maryport church, Bristol, the workmen discovered, very deeply concealed, a coffin of great antiquity. It is generally supposed that the corpse it contained was the body of —— Yeoman, Sheriff of Bristol in 1643, when the city was surrendered to the parliamentary army by Prince Rupert. Mr. Yeoman was hanged in Wine-street, opposite his own house, by order of Fairfax, for his attachment to the royal cause. The body was in the highest state of preservation, handsomely accoutred in the costume of the day, with gloves similar to those which the sheriffs at present wear. *And there were considerable tumours visible in the neck, which inclined several medical gentlemen, who inspected the body, to be of opinion that they were occasioned by strangulation.*" Edinburgh Ann. Register, vol. 7, Chronicle, p. 30.

if the suspension has been made after death, these marks will be wanting, and although there may be spots on the neck from the pressure of the cord, yet they will be of a livid colour, and distinguishable from contusions on the living body.* The appearances found on dissection are also an important guide.

The form and situation of the mark made by the cord should be ascertained : if it is at the bottom of the neck, it is probable that the individual has been strangled, for if suspended the cord would slip to the superior part of the neck. It may also happen, that a person is murdered by strangulation and afterwards suspended. In this case, we should expect to find two distinct circles on the neck, each characterised by its peculiarities.†

The presence or absence of dislocation or fracture of the vertebræ is not to be greatly relied upon in settling this question, as it may have been produced by force subsequently applied, such as pulling hard at the feet.

Wounds, effused blood and marks of violence are to be judged according to the rules laid down, when noticing medico-legal dissection.

Devaux mentions a case that illustrates this question. A female aged 50, at Mantes (in 1683) was found suspended from a beam in a barn. The face was not discoloured, no froth issued from the mouth or nose, the tongue was natural, there was no change of colour around the shoulders, nor was the neck marked by the cord. It was determined to examine the body minutely, and a short investigation discovered a small wound, directly under the right breast, which on being pursued, was found to have penetrated through the heart, and produced an effusion of blood in the thorax. It was evident that she had been thus murdered.‡

* The skin of the neck after death, says Petit, will be folded up and wrinkled by the cord. Foderè, vol. 3, p. 151.

† Male. p. 233—4. Mahon, vol. 3, p. 44.

‡ Devaux, quoted by Foderè, vol. 3, p. 153.

II. The second question is, *Whether the individual has hung himself, or has been hung by others?*

As a preliminary remark, I would observe, that hanging is a difficult mode of perpetrating murder, unless the strength of the parties be greatly disproportionate, or the assailants be numerous and powerful, and accordingly, we find it is most commonly an act of suicide. There are, however, cases in which a decision is extremely difficult, as the marks left either from homicide or suicide, may be precisely similar.

We should first ascertain whether suspension took place before or after death—and next, the immediate cause of death as before stated. The instrument of death, that is, the cord, should be compared with the furrow that it has made, so as to ascertain whether the diameter of the neck be much diminished by it. All the circumstances which indicate strangulation, are so far against the idea of suicide.*

The probability of the occurrence of luxation or fracture of the vertebræ, is also, as I have already hinted, lessened when suicide is the cause †

Wounds and marks of violence on the body, are generally to be deemed proofs of homicide. But there may be suicides who injure themselves previous to suspension. De Haen records a case, of a person who, while hanging, inflicted several wounds on his face. These, however, we should not consider as the cause of death. A still more remarkable case is mentioned by Ballard, of a young ecclesiastic, who cut his throat partially, and then hung himself in the

* Foderè observes, that in suicide, that portion of the cord which surrounds the neck, is relatively longer than in homicide, where the constriction will be more violent. The skin will also in this case be more drawn up towards the chin. (Vol. 3 p. 159.) Mahon remarks, that in assassination, the neck is sometimes so compressed, that the diameter of the circle described by the cord, is not more than two or two and a half inches. He saw a female who had been hung, in whom the integuments alone resisted the cord—the vertebræ, muscles, and larynx were separated, and the diameter of the circle was about two inches. Vol. 3, p. 49. It is, however, doubted, and I think justly, by Male, (p. 235,) whether this should be considered a conclusive proof of homicide. Much of the tightness of the noose must depend on its situation.

† There may, however, be instances of these occurring, as when the suicide throws himself from some height. Belloc, p. 173, 174.

vestments of his office, and which he had arranged for that purpose.*

Dr. Male has also suggested, that wounds may possibly be accidental, as when a person, by swinging himself with violence, breaks the rope, and wounds himself by falling upon articles of furniture.†

The situation of surrounding objects, the state of the clothes, the appearance of the body, all deserve attention. "If the person be not elevated from the ground or floor at all, while the cord is not so tight about the neck as to strangle in this posture, and no other cause of death can be discovered, there can hardly be a possibility of doubt as to self-murder. A few years ago, a man aged 75, destroyed himself at Castle Cary, by fixing a cord round his neck while sitting on the bed-side—leaning forward till his purpose was accomplished. His wife, who had for years been bed-ridden, and therefore not likely to have been fast asleep, was in the room during the transaction, and knew nothing of what was going on."‡

The state of mind of the deceased, his previous history, and situation in life, all deserve attention, and may aid us in forming an opinion, whether a predisposition to insanity has been present.

The following cases deserve the attention of all medical men.

A young man eighteen years of age, and named *Bartholomew Pourpre,* was found dead and hanging to a tree, at seven o'clock in the evening of the 12th of August, 1736. A surgeon, who examined the body, certified that he had been strangled. His father had married a second wife, who was on very ill terms with the young man, and had produced frequent quarrels and threats of murder between them. Suspicion was, therefore, excited, but its probability was destroyed by the idea, that a father would not murder his son, and also from the circumstance that he was fifty-two years old, and his son eighteen, and in full

* Ballard, p. 409.
† Male, p. 234.
‡ Smith, p. 278.

health and vigour. On this reasoning, the father was acquitted, and the son was deemed to have hung himself.

An order having, however, been made to prepare a statement of the suicide, and the cause being carried up to the parliament of Aix, the attorney-general discovered such facts in the statement of the surgeon, as led him to believe that Pourpre had not destroyed himself. It was mentioned not only by him, but by other witnesses, that the mark of the cord, instead of being at the upper part of the neck, was at its lower part, just above the shoulders; and secondly, that the teeth were knocked in, and bloody. The parliament, from these facts, decided that the father had strangled him, and had put his foot on the mouth of his son, either to prevent his cries, or to hurry on the strangulation. The suspension, they declared, was subsequent to his death. Whether the father was guilty or not, we must at least say with Foderè, that two facts are well established in this case: 1. That the son had been strangled before being hung; and 2. That the strangling had been done, not by himself, but by others.*

Marc Antoine Calas was the son of John Calas, a merchant of Toulouse, aged seventy years, of great probity, and a protestant. This son was twenty-eight years of age, of a robust habit, but melancholy turn of mind. He was a student of law, and becoming irritated at the difficulties he experienced, (in consequence of not being a catholic,) concerning his license, he resolved to hang himself. This he executed by fastening the cord to a billet of wood placed on the folding doors which led from his father's shop to his store-room. Two hours after, he was found lifeless. The parents unfortunately removed the cord from the body, and never exhibited it to shew in what manner his death was accomplished. No examination was made—the people, stimulated by religious

* Foderè, vol. 3, p. 152, cited from Louis.

prejudice, carried the body to the town-house, where it was the next day examined by two medical men, who, without viewing the cord, or the place where the death had been consummated, declared that he had been strangled. On the strength of this, the father was condemned by the parliament of Toulouse, in 1761, to be broken on the wheel. He expired with protestations to heaven of his innocence.

Reflection, however, returned when it was too late. It was recollected that the son had been of a melancholy turn of mind—that no noise had been heard in the house while the deed was doing—that his clothes were not in the least ruffled—that a single mark only was found from the cord, and which indicated suspension by suicide—and in addition to these, that the dress proper for the dead, was found laying on the counter. Voltaire espoused the cause of the injured family, and attracted the eyes of all Europe to this judicial murder. The cause was carried up to the council of state, who on the 9th of May, 1765, reversed the decree of the parliament, and vindicated the memory of John Calas.*

4. *Of persons found strangled.*

I have already in the previous section, indicated the difference between this species of murder and hanging, and indeed were it not for the sake of regularity, they might be considered together.

In strangulation, strictly considered, the distinction consists in the murdered not being suspended. It is a more common, and probably a more violent mode of murder than hanging, and we should therefore expect that the mark of the cord, ligature, or whatever else may be used, would be more distinct.

The appearances on dissection will not differ materially from those stated in the previous section, but there are some characteristic external appearances.

* Foderè, vol. 3, p. 167, from the *Causes Celèbres.* See also Grimm's Historical and Literary Mem, &c. (1753 to 1769,) vol. 2, p. 41, 117 and 166.

The mark of the ligature will generally form a *horizontal* discoloured circle round the neck, and towards its lower part, and we are to judge by rules already given, whether it was inflicted before or after death. The dislocation of the vertebræ is not to be expected, though there may be fractures of their processes, and in all probability, injury, to the cartilages of the larynx.*

The same questions are to be solved here as in the former section, *was the deceased really strangled, or was the rope fastened round his neck after he was dead.* This, I have endeavoured to answer in a former page, by directing attention to the state of the marks on the neck. There are however instances on record, where injuries have been inflicted on bodies strangled, to avert suspicion of the true manner in which they were killed.

Sir Edmundbury Godfrey, an eminent magistrate in Middlesex, (England,) was murdered on the 12th of October, 1677. The manner of his death, as proved by accomplices, on the trial of Green, Berry and Hill for his murder, was thus : having enticed him, under a false pretence, to a remote situation about Somerset House, a man came behind him, twisted a handkerchief, and threw it about his neck, when four of them threw him down and strangled him. Not entirely accomplishing their purpose in this way, the person who fixed the handkerchief, twisted his neck round, using violence to the body with his knee. This was on Saturday night. The body was concealed till the Wednesday night following, when about 12 o'clock, it was carried away in a sedan chair, and thrown into a ditch. They then passed his own sword through him, and laid his gloves and some other things on the bank, so as to excite the belief that he had committed suicide. In this situation the body was found, and on examination, it was observed, that an attempt had been made to run him

* Smith, p. 224.

through, but it was prevented by striking on a rib. There was no blood at this wound. The sword however passed quite through his body, projecting two hands' breadth beyond his back, and Skillard and Cambridge, the surgeons, deposed that it went through the heart. When the sword was drawn out, no blood followed, nor was there any about the place. The neck was dislocated, and so flexible that it could be turned from one shoulder to the other. His face during life had been always remarkably pale, but it was now much suffused. The eyes were blood shot, and there was a mark round the neck, an inch broad.*

Philip Standsfield was tried and found guilty, in 1688, of the murder of his father, Sir James Standsfield, of New Milns, in Scotland. This atrocious parricide appears to have been a man of vicious and debauched habits, and on extremely ill terms with his parent. He cursed him, and repeatedly swore that he would take his life. The father was murdered by strangulation in his bed-chamber, at the dead of night, and the body was afterwards taken, and carried to some water hard by. In the morning it was discovered lying on the top of the water, which was only five feet deep, and not a running stream, and although Philip was desired to delay the funeral, yet he caused it to be immediately interred. Suspicions were, however, excited, concerning the cause of death, and two surgeons were sent for from Edinburgh, by order of Sir John Dalrymple, the king's advocate, to examine the body. They, (James Murehead and James Craufurd,) had it dug up, and on inspection, found the following appearances, which I shall give in their own words. "Having, with all possible exactness, viewed the corpse, we observed the face a little swelled, and inclining to

* Hargrave's State Trials, vol. 2, p. 759 to 791. Burnet, vol. 2, p. 42. Smith, p. 225. Several persons were afterwards tried for stating that Sir E. Godfrey had murdered himself, but all the testimony adduced (see that of Lazinby and Hobbs,) only proved the fact of strangulation still more strongly. See Hargrave's State Trials, vol. 3, p. 505 to 518.

a dark reddish colour, some fullness of some capillarie veins in the pallat of the mouth towards the uvula, as also a large and conspicuous swelling, about three inches broad, of a dark red or blue colour, from one side of the larynx round backwards to the other side thereof; we observed the jugular veins on both sides the neck very large and distended, and full of blood; there was a large swelling under and betwixt the chin and cartilago scutiformis; there was also a little scratch below the left mandibula, which had rankled the cuticula, and made some little impression on the cutis. Having made incisions from the chin down about the larynx, and cross upon the swelling of the neck, we found a greater laxness and distance, (as we think) than ordinary, betwixt the cartilago scutiformis and os hyoides; we found the tumour on the neck containing bruises, like dark or blackish blood; the jugular, when cut, bled considerably, especially that on the left side.

"Having opened his breast, we found the lungs distended to the filling up of their capacities, but free of water; his stomach, liver, &c. were all in good condition; we found no water within the corpse; the corpse had no smell at all; the breast, belly, privy parts, &c. were all well coloured; there was no swelling in his belly, nor any thing but ordinary to be seen on his head."

This report was submitted to the deaconry of surgeons at Edinburgh, and they state, "*that though it is not usual to declare more than matter of fact,*" yet they, in obedience to his lordship's commands and enquiry, whether these symptoms import drowning or strangling, reply, that they indicate external violence, and such as could not be caused by drowning simply. On that part of the report, which details the appearances found on opening the breast and stomach, they observe, that *a body, when drowned, is generally found to have much water in it.* As this was not present in the deceased, as the lungs were distended, but free from water, and as the other circum-

stances mentioned in the report, indicated violence, they decided that there were just grounds to think that he was not drowned.

The college of physicians were also consulted, and answered that there was sufficient reason to believe that Sir James had been strangled, and not drowned.

Spurway, a person present at the dissection, proved that when Surgeon Murehead was moving the cap from the head, the eyes opened, and the eyelids were much swoln, and very red.

The defence set up was, that Sir James had drowned himself, and in reply to the argument that no water was found in the body, it was urged, that when a man commits suicide in this way, he will keep his breath, and thus prevent the ingress of the water. Various conjectures were also advanced in the pleadings, to account for the swelling of the neck, but did not prove satisfactory, and the parricide was with great justice condemned and executed.*

I shall adduce another case, to show the facility with which a person may be murdered in this manner. Dr. Clench, a physician in London, was called out of bed by two persons on the night of the 4th of January, 1692, who desired him to visit a friend who was not well. He entered a hackney coach with them, and drove about several streets in the city for an hour and a quarter. The two individuals then left the coach, and sent the driver on an errand. When the coachman returned, he found Dr. Clench sitting on the bottom of the coach, against the front seat, with his head against the cushion. Thinking him in liquor, he shook him, but obtained no answer. He then called the watch, and they found him strangled by a handkerchief in which a coal had been placed, and then the coal applied directly over the windpipe. The coachman had heard no noise while driving the carriage.†

It must however not be forgotten that strangulation

* Hargrave's State Trials, vol. 4, p. 283 to 303. † Ibid. vol. 4, p. 495.

is sometimes effected by other means, than a cord, ligature or handkerchief. It may be performed by the hand, and in this instance, instead of a circle round the neck, the discoloration will be partial, the bruises will be of an indistinct form, or the positive marks of fingers may be traced.*

In 1763, a man named Beddingfield, was murdered in England, and the charge was laid against his wife and man servant. The medical testimony was very unsatisfactory, as no dissection had taken place, but it was proved, there were marks about the neck resembling those of fingers. A contradictory account was however given of the number; one surgeon said a thumb and *three* fingers, the other, a thumb and *four fingers*, while another evidence who also saw the marks at the inquest, spoke of *two* only, "which looked as if the blood was set in the skin."

The defence was, that the deceased had fallen out of bed, and was found lying on the floor on his face, with one hand round his neck.

I am far from thinking that this could have been mistaken, if a proper examination had been made. The discrepancies in the testimony and the omission of dissection, might however have led to subsequent doubts, had not one of the condemned persons confessed that he had strangled Beddingfield, by seizing his throat with his left hand, while asleep, and that though the deceased struggled violently and made some noise, yet he soon accomplished his purpose.†

Sir John Dinely Goodere, in 1741, was forced by violence on board the Ruby ship of war, commanded by his brother, Capt. Goodere, and lying in the port of Bristol. In the night he was strangled by two assassins in the employ of his brother. One of them confessed, that the other fell on Sir John, as he lay in bed, took hold of his throat with his hand (his stock

* These marks are occasionally very slight. A young officer was strangled in his bed by a soldier. The surgeon of the regiment could find only one small spot, which the murderer afterwards confessed he had produced by violent pressure with his thumb. Metzger, p. 379.

† Smith, p. 227.

being on) and so strangled him with his stock. They then put a rope with a noose in it, round his neck and drew it tight, to insure the certainty of the murder. In accordance, with this, Mr. Dudgeon, the surgeon's mate, of the Ruby swore, that there were some marks on his neck, which looked like the scratching of nails, while blood came out of his nose and mouth.*

"On opening the bodies of those who are murdered by manual strangulation, the usual appearances of this kind of death may not seem so conclusive as in other cases, from the person making continued resistance, and the functions of respiration and circulation going on in some measure for a longer period than there where interrupted at once, as in the instance of drowning or the effectual application of a cord"†

In the case of a woman who had been strangled *per manum* by two men, Littre found the tympanum of the left ear lacerated, and from it, flowed about an ounce of blood; the vessels of the brain were unusually turgid, red blood was extravasated in the ventricles and also on the base of the cranium; the lungs were greatly distended, and their membrane very vascular. Not more than an ounce of blood however was contained in the right ventricle of the heart and it was fluid and frothy, like that of the lungs.‡

As to the question, whether *strangulation is the effect of suicide or homicide*, it may be remarked that it is extremely difficult for a person to destroy himself in this way, since his hands lose their strength the moment compression begins. All marks of violence are of course proofs of homicide, and the circular marks itself is *prima facie* evidence, unless contradicted by positive testimony.

Whether it is *possible* that a man has strangled himself, must depend greatly on the appearances, and in particular the position of the body, and the history of his state of mind. The following cases were communicated by Dr. Desgranges, of Lyons, to Foderè,

* Hargrave's State Trials, vol. 6, p. 816 and 831.
† Smith, p. 229. ‡ Foderè, vol. 3, p. 139. Smith, p. 229.

in 1811. A man was found in a hay-loft, strangled by a handkerchief, which had been tightened by a stick. The judicial tribunal consulted the Society of Medicine, whether this was a case of possible suicide. The society replied, *that it was possible ;* and Dr. Desgranges observes, that in a person who is firmly determined to destroy himself, it might be accomplished, by producing several rapid revolutions of the stick, and in this way, tightening the handkerchief effectually.

In another case, an old man in the hospital used the handle of a pot, as the instrument for tightening the ligature. He was found laying on the bed, with his face turned to the mattrass, the chin was cut by the pieces of the pot, the head was dark coloured, the face swelled, the lips thickened, and a sanguineous saliva issued from the mouth.*

I will only observe on these, that there is a bare possibility of their being instances of suicide, and that all similar instances require strong proofs to obtain our assent to this belief.

5. *Of persons found drowned.*

The present is an intricate, as well as interesting subject. I approach it with diffidence, and can only promise to give a faithful abstract of the current state of knowledge concerning it.

The leading question which every medico-legal case suggests is, *Whether there are any marks that distinguish death by submersion, from death previous to submersion?* or in other words, whether a person was thrown when alive, or after death, into the water?

I shall arrange my remarks on this in the following order: first, state the ancient doctrines ; and secondly, those most commonly received at the present day. It will then be proper to comment on the different marks, and show to what qualifications and exceptions they are liable. In doing this, the various the-

* Foderè, vol. 3, p. 173.

ories as to the cause of death from drowning, will require notice, and the whole subject may be then applied by detailing some medico-legal cases.

I. Ambrose Parè has stated in a few words, the ancient opinions on this subject. He observes, that a surgeon will find the following appearances on the body of a person who has been thrown into the water, while living. The stomach and intestinal canal are filled with water—a glairy mucus issues from the nose, and sometimes there is a bleeding from it—there is a frothy appearance about the mouth, and the extremities of the fingers will be found excoriated, as if, in dying, they had grasped the sand, or some other hard substance. On the contrary, those who have been thrown when dead into the water, will have no tumour in the stomach or abdomen, since all the passages to them were closed by the absence of inspiration; the nose and mouth will present none of the appearances mentioned above, nor will there be any excoriation of the fingers.*

These rules were considered orthodox until the commencement of the eighteenth century, and Deveaux reports several cases which were decided according to them.

II. I believe I shall be correct in stating, that the following marks, laid down by Dr. Marc, are recognized as correct by the great body of modern physiologists, with, however, certain qualifications, to be hereafter mentioned.

Signs that a person has been drowned while living. As to the external appearance of the body.

1. The eyes are half open—the pupils much dilated—the skin is remarkable for its paleness, originating in a spasm of the cutaneous vessels—the tongue approaches to the under edges of the lips, and these, as well as the nostrils, are covered with a frothy mucus. Occasionally when the paleness is wanting, the head will be bloated, the face red, and all the symp-

* Quoted by Foderè, vol. 3, p. 80.

toms which denote a determination of blood to the brain, will be present.

2. The excoriation at the ends of the fingers—dirt or sand found under the nails.

As to the appearances on dissection.

3. A greater or less fulness of the blood-vessels of the brain.

4. The right side of the heart and its vessels filled with blood, and the left empty—the lungs dilated and filled with blood.

5. A watery froth, which is sometimes bloody. found in the trachea and bronchiæ.

6. The diaphragm depressed into the abdomen.

7. The blood in a permanently liquid state, and oozes from the body on the least touch of the scalpel.

8. Water is occasionally found in the stomach.

On the other hand, the *signs that denote death previous to submersion*, are,

1. The presence of lesions which could not be inflicted under water, such as the marks of ecchymosis. or of a cord around the neck—wounds from fire-arms, or the traces of poisons.

2. The absence of the external characters mentioned above.

3. The absence of water or foreign substances in the trachea and stomach.

4. The lungs being in a state of collapse, and not gorged with blood—the abdomen flat, and the diaphragm in a state of natural tension.

5. The blood in a coagulable state.*

III. In proceeding to review the signs now enumerated, we are immediately struck with the variety that is observed in the *external appearance* of the drowned. The countenances of many are pale, while there occur cases in which the face is livid, and the head swelled. To explain this difference, Dr. Desgranges has suggested, that there are distinct modes of death operating in each. One of them he denomi-

* Marc, p. 172 to 182.

nates *nervous or syncopal asphyxia*, and it is well illustrated by a case related by Plater. A female convicted of infanticide, was condemned to be drowned. She fainted on being immersed into the water, and remained there for a quarter of an hour. On being drawn out, she recovered her senses.* This class will be characterized by paleness, in consequence of a spasm of the cutaneous vessels. Fear, or the coldness of the water, or a blow on the head in falling, suspends as it were the vital functions, and throws the nervous system into a state of inaction.

The second is denominated *asphyxia by suffocation*. The drowning person wishes to respire, and in consequence, a small quantity of water enters the bronchiæ, mixes with the air in them, and forms the frothy mucus so commonly perceived. The lungs are in this case totally unable to perform their functions.†

Dr. Marc has added a third to these, which he styles *asphyxia from cerebral congestion*, and refers to it such cases as are marked by an apoplectic habit, or where persons fall into the water when in a state of intoxication, or with a full stomach.

In many instances, the two last are, in his opinion, united, and suffocation and apoplexy, according to circumstances, act reciprocally either as the essential or aggravating cause of death.‡ It is in these, of course, that we are to look for lividness and swelling of the countenance.

If then we take the above division into consideration, and apply it in medico-legal cases, we have next to enquire whether the external appearances already enumerated, are certain diagnostics of submersion while living. To a limited extent they undoubtedly are, but they are also liable to exceptions. Fothergill has suggested as a characteristic sign in these cases, that the eyes are found half open, and the pupils very

* Marc, p. 165. This punishment was in compliance with the ancient provisions of the Caroline code. The criminal was put into a sack, and sunk into the water.

† Foderè, vol. 2, p. 296. ‡ Marc, p. 166, 169.

much dilated; but this enlargement of the pupils may have originated from the use of narcotics, and thus death may have preceded drowning. The same remark applies to the appearance of the eyes. Spasmodic diseases, amongst others, will leave them in that state. Again, the paleness may have been the consequence of hæmorrhage or inanition. Froth at the mouth, and projection of the tongue, accompany convulsions and epilepsy; while redness of the visage, and swelling of the head, are the most common signs of death from apoplexy.*

The excoriation at the ends of the fingers, and the presence of dirt or sand under the nails, were formerly much depended upon, and Ambrose Paré and Bohn in particular, rely greatly on it, since it indicates, according to them, the last efforts of the *living* individual to save himself from death. Like the last, however, it is rather to be deemed a supplementary than a conclusive proof. A man may fall during a state of intoxication into the water, and never make an effort to save himself, or he may be in a state of syncope when drowned. No mark of exertion will then be found†—while, on the other hand, a dead body may, from being thrown from a high place, contract this appearance in rolling over. The depth of water in these instances, should be noticed, since there may be an extinction of life before coming at the bottom.

While then the external signs are to be strictly noticed, but not greatly relied on, we come next to the more conclusive marks, drawn from the appearances on dissection.

A greater or less fullness of the blood vessels of the head, together with the fullness of the right side of the heart, and its vessels, has been much relied upon as a sign by several anatomists. Hopffenstock, a physician of Prague, in his dissection of the drowned, observed constantly a great accumulation of blood in the

* Marc, p. 173. † Mahon, vol. 3, p. 3.

cerebral vessels ; the jugular veins ; the right auricle and ventricle, and in the pulmonary artery—while, on the contrary, the left side of the heart was completely empty. This led him to suppose, that the stagnation of blood in these vessels was the cause of death, and that this again was occasioned by the cessation of respiration.* Mahon states, that he observed the same appearances in his dissections ;† and Kite and Walter have confirmed it by their investigations.

But it may be questioned whether the brain is always thus gorged with blood. Certainly, in those who die from *syncopal asphyxia*, this mark will be far from being a striking one ; while, on the contrary, should apoplexy have taken place previous to drowning, we might expect its presence.‡

The next mark is, *the presence of a small quantity of water, very frothy, and sometimes coloured with blood in the trachea and bronchiæ.* This has been a subject of great speculation among physiologists, and formerly the water thus found in the lungs and stomach was supposed to be the cause of death. Becker, a German physician, was the first to controvert this opinion. He published a work at the commencement of the eighteenth century, in which he denied that water was always present in these organs, and illustrated his position by several dissections of the human body, as well as by experiments on animals.‖ Some distinguished men, as Littre, Senac and Petit, embraced his views, although towards the end of the last century, many physiologists, as Haller, De Haen and Louis, inclined again to the ancient idea.§

* Foderè, vol. 3, p. 90. † Mahon, vol. 3, p. 30.

‡ Goodwyn states as the result of his investigations, that the external surface of the brain is of a darker colour than usual, but the vessels are not turgid with blood, nor are there any marks of extravasation about them. The right side of the heart is, however, according to him, filled with black blood, while the left ventricle is only about half filled with blood of the same colour. Enquiry, p. 4 and 5.

‖ This work is published in the Novellæ of Valentini. "J. C. Beckeri Paradoxum-Medico-Legale, *de submersorum morte, sine potu aqua*, 1704," p. 299. See also a notice of this work in the Phil. Trans. vol. 24, p. 2512. Bohn of Leipsic published an essay in 1711, in which he advanced the same opinion. See Memoirs of Literature, vol. 4, p. 165.

§ De Haen's Ratio Medendi Continuata, p. 130 &c. Louis' Memoire sur Les Noyès.

There are, however, abundant facts on record to prove, that this frothy mucus is not invariably found. Wepfer and Valdsmidt did not observe it in an animal which they drowned. Evers made a number of experiments at Gottingen, in 1753, on cats, and always found it, but could discover none in the bodies of two persons who were drowned when intoxicated.* Belloc remarks that he has not found it in cases where persons were undoubtedly drowned while living.† And he explains this variety, by suggesting that the last act of the person who falls into the water, may be either inspiration or expiration. If the former, a small quantity of water will reach the lungs, which, mixing with the air contained there, will, by the succeeding process of expiration, form the froth in question. On the contrary, if the last movement be expiration, he does not believe that the water can reach the trachea, and consequently that no froth will be formed.

Foderè suggests, with reference to a previous division, that this mark will not appear in the *syncopal asphyxia*, or *asphyxia from cerebral congestion*, while in *asphyxia from suffocation*, it will be a constant attendant. The inhabitants of Geneva, according to Dr. Fine, have a very bad habit of bathing immediately after a full meal, and in these, according to the above classification, should drowning occur, it might not probably be found.

The most received opinion on this point is then the following: the presence of this frothy mucus is not a certain event, nor is it by any means an essential cause of death.‡ As long as there is sufficient

* Foderè, vol. 3, p. 93, 94. † Belloc, p. 178.

‡ Dr. Goodwyn made an opening into the trachea of a cat, and through this introduced two ounces of water into the lungs. The animal had immediately a difficulty of breathing, and a feeble pulse. But these symptoms soon abated, and it lived several hours afterwards without much apparent inconvenience. After this, he strangled it, and found two ounces and a half of water in the lungs. Enquiry, p. 17. Prof. Mayer has lately confirmed this opinion by numerous experiments. Among other results, he mentions, that "animals support a considerable quantity of liquid injected into the lungs, without experiencing mortal symptoms from them. Rab-

strength left, the epiglottis will resist the passage of the water, except the slightest quantity, and it is probable that this small quantity is taken in during the last inspiration, mixes with the pulmonary mucus, and produces the frothy appearance.

But it may be asked whether this mark does not accompany other diseases, and causes of death? There is no doubt but that it has thus been occasionally observed. De Haen has seen it in the body of a person who was hung, and Marc confirms it by a case which he himself examined.

In those who die from epilepsy, apoplexy, or violent catarrhal affections, it is witnessed, and also in death from irrespirable airs.

These facts lessen our dependence on this sign to a considerable degree, and it will be wholly weakened, if the body has lain for any length of time in the water. Putrefaction soon forms a frothy fluid, strongly resembling the appearance in question.*

As to another difficulty on this point, viz. whether water can enter the lungs after death, there does not seem to exist much doubt. The general opinion is, that the parts will be in such close contact, that none can penetrate. Foderè however inclines to the opposite belief, and suggests, that when the body has remained for some time in the water, and putrefaction commences, it will enter upon hydrostatical principles. And again, although the muscles about the

bits can support a dose of four ounces and a half in 24 hours. But these injections should be performed by an opening made into the trachea, for if we inject these fluids by the larynx, they excite the most severe symptoms of suffocation, and the animal soon sinks under it. The suspension of respiration during this irritation of the muscles of the larynx by the injection, is the only cause of death." Again. "The symptoms of suffocation which arise from injections, are not serious when we inject pure water, but they become so when we take thick fluids, for example, all which obstruct the ærial passages, or some chemical solutions, which, destroying the parenchyma of the lungs, prevent the oxydation of the blood, and produce extravasations of blood and inflammation in the lobes of the lungs. The fluids and solutions injected into the lungs, are absorbed more or less quickly, according to their nature and degree of concentration. The absorption is in general very great, but less in young and newly born animals than in adults." Edin. Med. and Surg. Journal, vol. 17, p. 469.

* Mahon, vol. 3, p. 5, &c.

larynx and pharynx are ordinarily, in such cases, in a convulsed and constricted state, yet circumstances may occur, to leave them in a relaxed one.* But he refutes his own opinion by a subsequent remark. Water, when introduced after death, can never mix with the air so as to form the peculiar froth in question.†

The deduction then from this disquisition is, that the presence of the frothy mucus, is strong presumptive evidence that the deceased was drowned while living, provided we are satisfied that death has not happened from irrespirable air, epilepsy, apoplexy, &c. The examination must however be made shortly after death and before putrefaction has commenced. The proof will be greatly strengthened, if we discover in the bronchiæ or lungs, foreign bodies similar to those contained in the water, such as mud, weeds, &c. Lastly, the glottis should be erect. These are the qualifications that are added by Dr. Marc, to this test.‡ It must however not escape our recollection, that the absence of this frothy mucus is not a conclusive proof that the individual was dead before submersion.

The depression of the diaphragm into the abdomen is considered by Hebenstreit as an essential character. It is wanting, according to him, in those who are drowned after death. Probably the reason of this is, that the last act of breathing is inspiration. The examination with respect to it should always be made early, and the proof should not be deemed of much value, if inflation of the lungs has been used in endeavouring to restore life.‖

The *liquidity of the blood* was formerly greatly insisted upon, as a most important proof of death by drowning. And this is observed, even in the vessels which enter the bones. If the pericranium be sepa-

* Foderè, vol. 3, p. 98, 100.

† Foderè, vol. 3, p. 111. Belloc, p. 180, makes a similar observation.

‡ Marc, p. 176.

‖ Marc, p. 177. Foderè, vol. 3, p. 103. The former intimates a suspicion that this sign may also occur in death from noxious inhalations.

rated and the blood be taken up with a sponge, it will immediately appear in dots along the surface of the bone.* But, (as we have already stated,) this phœnomenon occurs in persons found dead from noxious inhalations, and it is a consequence of poisoning by opium. Its diagnostic character is thus affected, and Mahon indeed denies its invariable appearance, and observes that in some cases, he has found the blood coagulated. It is evidently not a sign deserving of much consideration.†

As to the presence of *water in the stomach*, we may remark, that it is an accidental circumstance, and in no way connected, as was once supposed, with the cause of death. Goodwyn and Kite have proved by their experiments, that a quantity may be swallowed during the struggles of a drowning person, but there are also cases on record, where none was found.

Senac illustrated this subject nearly a hundred years ago, by detailing the method then used in Paris for torturing criminals, and under which, the subject occasionally died. The mouth being forcibly kept open with a wedge, and the nostrils closed, a great quantity of water was poured into the person's throat. Respiration was thus prevented, while the irritation of the trachea, in resisting the access of fluid, caused faintings, convulsions, violent agitation of the respiratory organs, rupture of the pulmonary vessels, spitting of blood and death, but *very little water entered either into the lungs or the stomach* of these unfortunate persons. On dissection however, the usual lesions observed in death from submersion were apparent.‡

* Marc, p. 179.

† Marc proposes to identify this appearance by the following marks :—In death from irrespirable gas, it will be accompanied with a "*flegmasie pulmonaire plus ou moins legere, qui quelquefois s'etend jusqu' au bas ventre ;*" and after poisoning, there is an *inflammation more or less intense in the stomach and alimentary canal.* Both are characterized by a *very rapid decomposition.* In death from drowning, the above appearances will be wanting, and putrefaction does not come on so rapidly. Marc, p. 180.

‡ Smith, p. 210. It was formerly thought, that if no water was found in the stomach or bronchiæ, death could not have been occasioned by drowning. See the subsequent notice of the trial of Spencer Cowper.

While then it is possible that water may occasionally be found in the stomachs of those who have been drowned, it becomes a question of some interest, whether it can enter after death. Experiments so far as they have yet proceeded, are decidedly opposed to this. Goodwyn and Kite never found any in the *intestines* of animals, and laterly Dr. Fine of Geneva, has ascertained that it cannot be introduced into the stomachs of the dead, except by passing an elastic sound into the œsophagus. The sides of that canal, when in a state of inaction, appear to be in close contact.*

From the remarks which have now been made, it is obvious, that no single proof taken separately is perfectly satisfactory, and that several must be united in order to arrive at a just conclusion. The presence of frothy mucus in the trachea, is undoubtedly the sign of the greatest importance.

It is not necessary, after what has been already said, to enter into a disquisition on the cause of death by drowning. Opinions have varied greatly at different times, but the received doctrine at present is, that the extinction of life is caused by the stoppage of respiration, and the exclusion of atmospheric air from the lungs. Dr. Cullen seems to have been among the first who promulgated this belief, and it has been fully sanctioned by subsequent experiments.†

As to the marks of violence which may be found on the bodies of the drowned, they are with great propriety divided by Foderè into three classes.

1. Those which are totally independent of any connection with the circumstance of drowning. Of this nature, are the usual signs of poisoning—a regularly formed ecchymosis around the neck, indicative of strangling, or wounds inflicted by fire arms, or cutting instruments. All these lesions have an essen-

* Marc, p. 160. We should recollect in disputed cases, that the drowned person may have drank some water immediately previous to submersion. Compare this with the fluid in which he is found.

† See Letter to Lord Cathcart, by William Cullen, M.D. Edin. 1784, p. 6.

tially distinct character, which cannot be mistaken. And hence the evident importance of examining all bodies drawn from the water. It was by pursuing such an investigation, that Deveaux discovered, under the breast of a woman, a wound which had penetrated to her heart.

2. There are marks of violence which may have resulted either from accidents attending submersion, or from previous homicide, and these are unequal, irregular wounds, which do not penetrate far into the body—contusions, fractures and luxations. In all such instances, ascertain, if possible, the height from which the person has fallen, and the resistance he may have encountered.* The rapidity of the current and the sharpness of the banks, may also have caused wounds. The obstacles which might have been encountered should also be noticed. Dr. Fine remarks, that the rapidity of the Rhone, and the numerous mills erected on its banks, often produce most shocking wounds on the bodies of those which are driven against the stakes in the stream, or are drawn into the machinery.†

3. Lastly, there may be lesions received after death. These are to be determined by the rules laid down in the section on medico-legal dissection. The progress of putrefaction deserves particular attention in this case.‡

Before proceeding to illustrate this subject by a few examples, it is proper to mention one or two circumstances which may become objects of enquiry. The *buoyancy* of bodies in the water has given rise to considerable discussion, and facts directly opposite to each other have been adduced. There is no doubt,

* "A few years ago, a man who had leaped from each of the then three bridges into the Thames with impunity, undertook to repeat the exploit for a wager. Having jumped from London bridge, he sunk, and was drowned When the body was found, it appeared that he had gone down with the arms in the horizontal, instead of the perpendicular posture, in consequence of which, both of them were dislocated by the fall upon the water." Smith, p. 214.

† Marc, p. 183.

‡ Fodere, vol. 3, p. 112 to 115.

however, that a person, whether dead or alive, when first thrown into the water, will sink, unless buoyed up by external aid ; but after the process of putrefaction has occasioned the evolution of gaseous matter, to render the body specifically lighter than the water, it will rise to the surface ; and it is on this principle that bodies committed to the deep have generally weights affixed to them.

It is, however, possible that the body may float at first, when its cavities have been previously filled with air, and it is also an opinion, that deep water is more favourable for this than shallow. These, however, are circumstances of minor importance.* There is more consequence attached to the enquiry, *how long a body has lain in the water*. There is no mode by which this can be accurately ascertained, except that of circumstantial calculation, and the general facts which we mentioned when noticing the subject of putrefaction. It is of great importance, however, to recollect, that the animal body, by laying under water, becomes converted into a fatty substance termed *adipocire*, and which in appearance resembles spermaceti.† Water in any situation will produce this change, although running water has been found to do it more rapidly. The question, how long a time is necessary to cause this change, has been made the subject of legal enquiry.

"At the Lent assizes held at Warwick in the year 1805, the following cause came before the court. A gentleman, who was insolvent, left his own house with the intention (as was presumed from his recent conduct and conversation) of destroying himself. Five weeks and four days after that period, his body was found floating down a river. The face was disfigured by putrefaction, and the hair separated from the scalp by the slightest pull; but the other parts of the body were firm and white, without any putrefac-

* Smith, p. 211–12.

† See Dr. Gibbes' papers on Adipocire, in Phil. Transactions, vol. 84, p. 169; vol. 85, p. 239.

tive appearance. The clothes were unaltered, but the linen was exceedingly rotten. On examining the body, it was found that several parts of it were converted into adipocire.

A commission of bankruptcy having been taken out against the deceased a few days after he left home, it became an important question to the interest of his family, to ascertain whether or not he was living at that period. From the changes which the body had sustained, it was presumed that he had drowned himself on the day he left home, and to corroborate this presumption, the evidence of Dr. Gibbes of Bath was requested, who, from his experiments on this subject, was better acquainted with it than any other person. He stated on the trial, that he had procured a small quantity of this fatty substance, by immersing the muscular parts of animals in water for a month, and that it requires five or six weeks to make it in any large quantity. Upon this evidence, the jury were of opinion that the deceased was not alive at the time the commission was taken out, and the bankruptcy was accordingly superseded".*

IV. Spencer Cowper, Esq. a member of the English bar, and three other individuals, were tried at the Hertford Assizes, in 1699, for the murder of Mrs. Sarah Stout. Mr. Cowper came to Hertford on Monday, the 13th of March, and shortly after visited Mrs. Stout, who lived with her mother, of the same name. He dined with them, and staid till four in the afternoon. When he went away, he promised to return and lodge there that night. Accordingly, at 9 o'clock, he arrived, eat some supper, and then engaged in conversation with Mrs. Stout, the daughter. They were alone in the room, when she called a servant, and desired her to make a fire in his chamber, and to warm his bed. The direction was attended to, and in about a quarter of an hour, the servant heard the door shut, as if some one was going out.

* Male, p. 239, 240.

She remained above about a quarter of an hour longer, and then came down into the room. Mr. Cowper and Mrs. Stout were both gone, and the next morning she was found dead, and *floating* on the water. Its depth was about five feet, and her body was about five or six inches under it, although some of her clothes were on its surface. Her eyes were open, and some little froth issued from her mouth and nostrils. The body was not tumified, nor were any bruises observed. This is the testimony of the individuals who took the body out of the water.

Mr. Dimsdale, a surgeon, was sent for by the mother, to view the body. He found both sides of the neck swelled and black, and the skin between her breasts up towards the collar-bone, was also dark-coloured. The left wrist was slightly bruised. There was, however, no circular mark round the neck. It is to be regretted that this investigation proceeded no farther.

On the 28th of April, six weeks after the death of Mrs. Stout, her body was disinterred for the purpose of inspection. The medical witnesses stated, that they found the head and neck so much putrefied, that no opinion could be formed respecting their appearance. The stomach and intestines were, however, in a sound state, as were also the lungs. Neither of them was putrefied, and on making incisions into them, no water could be discovered.

Drs. Coatsworth, Nailor, Burnet and Woodhouse, with Mr. Babington a surgeon, deposed, that when a person is drowned, water will be taken into the stomach and lungs, and as none was found in this case, they were of opinion that she came to her death by some other means.

The above is an abstract of the testimony on the part of the crown. On the part of Mr. Cowper, it was first attempted to be shown, that the peculiar position of the body was owing to its laying sideways against some stakes in the river. These prevented its complete immersion under water, and a witness

also mentioned, that in drawing the body out of the water, one of the arms rubbed against the stakes, and thus probably produced the injury observed on it.

Drs. Sloane, Garth, Morley, Wollaston and Crell, together with William Cowper, the celebrated anatomist, appeared as witnesses for the prisoner. They were all asked concerning the circumstance of no water being found in the body, and whether this disproved the probability of drowning. Dr. Sloane considered it altogether an accidental appearance in the stomach, and not necessarily present in such cases. The others advanced similar opinions. As to the fluid in the lungs, the answers were not very definite, but it was insinuated by some, that the six weeks' burial might have dissipated whatever was taken in.*

During the trial, it was a subject of keen enquiry, whether dead bodies float or sink when thrown into the water. Seamen were summoned to depose on this point, and they testified that weights were fastened in order to produce their descent. The explanation of Dr. Garth is, however, perfectly satisfactory on this point. It is the same which is mentioned in a former page. Weights are added to prevent the buoyancy when putrefaction commences. In answer to a question from the judge, (Baron Hatsell,) Dr. Garth remarked, that the body of a strangled person might possibly float, on account of the included air. In this instance, however, there was no proof of such a cause of death.

Dr. Crell insisted much on the presence of the frothy mucus about the mouth and nostrils, as a proof that Mrs. Stout had been drowned.

The coroner's jury had returned a verdict of *non compos mentis*, and Mr. Cowper, on the trial, attempted to prove a previous melancholy state of mind. This, of course, was for the purpose of rendering it probable that suicide had been committed.

* Dr. Morley suggested, that if the female intended to destroy herself, she might, by keeping her breath, only take in a very small quantity of water.

These were the leading medico-legal facts and opinions elicited on the trial, and the jury, after remaining out about half an hour, brought in a verdict of not guilty.*

A case resembling the above in several particulars, has happened in this state.

Levi Weeks was, on the 31st of March, 1800, put upon his trial, before the court of oyer and terminer at New-York, for the murder of Gulielma Sands. The principal circumstances were as follows :—The deceased and the prisoner lodged in the house of Mr. Ring, who was a distant relative of the former. She received attentions from the prisoner, and told Mrs. Ring that she was to be married to him on Sunday, the 22d of December, 1799. When the evening arrived, she dressed herself, and came down into the lower room, where the prisoner was. Shortly after, she again went up stairs, whither Mrs. Ring followed her, saw her put on her hat and shawl, and take her muff in her hand. While in this state of preparation, Mrs. Ring came down stairs into the room, and found her husband and Levi sitting together. The latter instantly took his hat and went out into the entry, and the moment the door opened, Mrs. Ring heard a walking on the stairs, and directly a whispering at the door. She soon heard them walking along, and presently the front door opened, and the latch fell. The time she accurately fixed at about ten minutes after eight. Weeks returned to his lodgings at Ring's at ten o'clock. Gulielma's body was found in the Manhattan well, on the 2d of January, 1800.

As to the circumstantial evidence, I will only add the following. It was proved by a witness, that

* Hargrave's State Trials, vol. 5, p. 193 to 231. This case gave rise to several bitter pamphlets, in which the whole course of testimony was reviewed, and the characters of Mrs. Stout and Mr. Cowper were treated with little mercy. See vol. 8, p. 485 to 512. The opponent of Mr. Cowper accuses him or his accomplices in broad terms, of having felled her with a blow under the ear, and then strangling her with his hand. Such an opinion is, however, hardly tenable, as Dimsdale and Camlin both stated, that the stagnation of blood which was present, did not materially differ from what is usually observed in the drowned.

Weeks had spent the evening with him from half past eight until ten; and again it was testified, that it took fifteen minutes to walk from Ring's to the well.

The medico-legal testimony was of the following import. The body was carefully drawn up, so as not to touch either side of the well. Her hat, handkerchief and shoes were gone, and her clothes torn. On the right hand there was something like a bruise, and there were scratches of sand upon her skin, some of which was knocked off, and seemed to have been driven forward. The right foot was bare, and somewhat scratched on its upper part, as if she had been dragged on the ground. Her countenance was flushed, and her arms and neck very limber. Drs. Prince and Mackintosh examined the body before the coroner's jury, on the 3d January. It was ascertained that she was not pregnant. The scarf-skin of the face was scratched as if with gravel, and there was a bruise on the knee. There was a livid spot on the breast, but none on the neck. In the body, a small quantity of water was discovered. Both these gentlemen deposed, that in their opinion, all the appearances could be accounted for on the supposition of her having been drowned.

Dr. Hosack saw the body on the day it was interred. He was struck with the unusual redness of the countenance, and upon looking at the neck, observed three or four dark-coloured spots, of an irregular shape, but not in an exact line. The largest were about an inch and an half, and the smallest about three-quarters of an inch. He was decidedly of opinion that these were marks of violence done to the neck, and did not conceive it possible that they could have been committed on one's own person. Other witnesses had also observed these spots on the neck.

Towards the conclusion of the trial, Dr. Hosack was again called, and asked whether there was any explanation by which the medical testimony, apparently so discordant, could be reconciled. He replied, that it might, in either of two ways. First, the

spots were probably not so visible, when the body was first taken out of the water, as after it had been exposed to the air for some days. The gradual progress of putrefaction might have developed this appearance in the injured part. Secondly, when she was first taken out of the well, it was generally supposed that the neck and collar bone were broken. As Dr. H. did not see her until the day of interment, it is possible that the frequent turning and bending of the head, and the repeated examinations of the neck, to ascertain the injury done to the collar bone, might have produced the spots in question, and as the body had been dead for several days, a little violence might have produced a rupture of the cutaneous vessels, and a consequent effusion under the skin.

The prisoner was acquitted.*

I cannot avoid venturing a single remark on this case. The prisoner was doubtless innocent, but there are strong proofs to my mind, that the deceased suffered violence, previous to falling or being thrown into the well. The weather was undoubtedly cold, (it was during the holidays,) and the progress of putrefaction during immersion, must unquestionably have been very slow.† The coroner's jury viewed the body on the day after it was drawn up. Dr. Hosack, and other witnesses, sometime thereafter. Is it not probable that exposure to the air developed

* Report of the trial of Levi Weeks, &c. taken in short-hand by the clerk of the court, (Wm. Coleman, Esq.) 8vo. N. York, 1800.—In the Causes Celèbres, par Mejan, vol. 5, p. 127, a case is related, of an individual taken from the water, around whose body a bag containing several large stones was suspended. Distinct marks of compression were observed in the neck, and on dissecting through the skin, blood was found effused in situations corresponding to the external ecchymosis. One of the cervical vertebræ was luxated. The accusation was, that he had been strangled previous to the immersion; while the defence set up, rested on various proofs of previous insanity, and it was insinuated that the luxation might have originated from the fall into the well. The jury (Feb. 12, 1808,) acquitted the *persons accused*, but certainly no proofs need be stronger to determine the fact of murder previous to submersion.

† On the 19th of Jan. 1810, the Hon. Mr. Eden, son of Lord Auckland, was missing, and in March following, his body was found in the Thames. Mr. Holt, surgeon, gave his opinion to the coroner's jury, that at this season of the year, a body *might be a month or five weeks in the water, without becoming putrid.* Edin. Ann. Reg. vol. 3, part 2, p. 42.

these marks of injury, and do not these marks indicate strangulation previous to immersion?

There is a second question belonging to this subject, which is no less intricate than the first. *Was the drowning the effect of accident, of suicide, or of homicide?* I can offer but a few observations on it.

We should enquire particularly as to the situation in which the body is found—notice whether the stream is rapid or still water, and whether its banks are precipitous or sliding. Ascertain whether the individual has laboured under near-sightedness, vertigo, or symptoms of insanity. The bruises on the body should be examined, and a minute dissection be made. We should, however, recollect, that the person may have precipitated himself into the water, and struck against a stone or other hard substance, and the body may have thus been wounded.* In other cases, accidental circumstances may clear up the subject, as the marks of footsteps on the margin of the water, and substances found grasped in the hands of the deceased, that have evidently been seized while making resistance.†

It is an opinion with some writers, that less water is found in the lungs of suicides than in those who are drowned by accident, or wilfully; but this is evidently uncertain and unfounded.

In March 1806, a young woman at Little Sheffield, in Yorkshire, made way with herself, by breaking a hole in the ice upon a pond, and thrusting her head in, while the rest of the body remained out. This situation repelled the idea either of force or of accident.‡

In 1776, a young man named Paulet, of a violent and gloomy temper, was found dead at the bottom of

* Male, p. 236.

† "In the case of Mr. Taylor, aged 20, who was murdered at Hornsey in Dec. 1818, marks of footsteps, deep in the ground, were discovered near the New river, and on taking out the body, the hands were found clenched, and contained grass, which he had seized from the side of the water." Smith, p. 215.

‡ Smith, p. 275.

a well. Strong suspicions attached to two individuals. The medical reporters stated that they found sand under the nails of his hands ; a circular mark on his ankle-bones, external contusions on the head and particularly above the left superciliary ridge, and some cuts on the top of the scalp. On opening the thorax, the whole extent of the trachea down to the lungs was found filled with frothy mucus, and the stomach was half full of a whitish water. They considered these as marks of death by drowning. It was proved that the well was so surrounded by houses, that the slightest noise at it would have been immediately heard, and it was also constructed with sharp and heavy stones. The marks on the ankle-bones were alone of a doubtful nature, but as Paulet had been melancholy, and refused sustenance for several days, and every other circumstance could be satisfactorily explained, the parliament of Toulouse liberated the accused, and agreed that suicide had been committed.*

One would imagine, says Dr. Smith, that if a person be taken out of the water tied hand and foot, there need be no hesitation about inferring that he had been forced into that situation, yet a probable instance to the contrary, happened lately in London.

In June 1816, the body of a gauging instrument-maker who had been missing for some days from his home, was discovered floating down the Thames. On being taking out, his wrists were found tied together and made fast to his knees, which were in like manner, secured to each other. He had been in a state of mental derangement for two years. The cord with which he had tied himself was recognized as one that had hung from the ceiling over his bed, and by which he used to raise himself up, as he had been confined to bed for some weeks. He was a good swimmer, and it was presumed he had taken the precaution to prevent himself from employing that power. The verdict in this case was, "found drowned."†

* Foderè, vol. 3, p. 127, from the *Causes Celèbres*.. † Smith, p. 276.

6. *Of persons found smothered.*

There is but little to be said concerning this species of suffocation, and I introduce it only because I would not omit a notice of any cause of death.

Smothering is the covering of the mouth and nostrils in any way, so as to prevent the free ingress and egress of air. It happens most frequently with children, either as an accident or a crime—and in the former case, from *overlaying* them, as it is called. This occurs by a pillow, bolster or bed clothes, coming in contact with their face in such a manner, that their struggles cannot remove it.

Adults in a state of intoxication, or debility, may also be destroyed by getting into a position which prevents the transit of air to the lungs, and then being unable to extricate themselves. It will seldom be used as an instrument of homicide, since a moderate degree of resistance can generally prevent its effectual application.

Death in these cases is the direct consequence of the passage of the blood through the lungs being prevented, and we must of course expect to find correspondent proofs on dissection. But marks of external violence will not generally be perceived.

Dr. Smith also adverts to a mode of suicide said to be practised by negroes, which is, that of doubling back the tongue and swallowing it down into the fauces so low, as completely to choke the individual. This is certainly an extraordinary way of ending life.

In death by smothering, circumstantial evidence must be the principal, if not the only means of ascertaining whether the event has been produced by crime or by accident. Tumors pressing on the organs of respiration, or foreign bodies found in the trachea or œsophagus are of course, indications of accidental death.*

* Smith, p. 229 to 232. Foderè vol. 3, p. 177.

7. *Of persons found dead from wounds.*

The general course of investigation in cases of this nature, has been laid down in the section on medico-legal dissection, and we have only to consider the important question, whether the *wounds are the result of suicide, of accident, or of homicide.*

I must preface my remarks by observing, that in legal medicine the term *wound*, is used in a much more comprehensive sense than in surgery. In the latter, it means a solution of continuity ; in the former, injuries of every kind that affect either the hard or the soft parts, and accordingly under it are comprehended, bruises, contusions, fractures, luxations, &c.

The preliminary object necessary in these cases, is to enquire into the appearances on the body, and to ascertain whether they belong to ecchymosis, or sugillation. The distinction between these has already been stated. We should then pay great attention to the following circumstances : the situation in which the wounded body is found—the position of its members, and the state of its dress—the expression of countenance—the marks of violence, if any be present on the body—the redness or suffusion of the face. This last is important, as it may indicate violence, in order to stop the cries of the individual. The quantity of blood on the ground, or on the clothes, should be noticed, and in particular the nature of the wound, its depth and direction. In a case of supposed suicide, by means of a knife or pistol, the course of the wound should be examined, whether it be upwards or downwards, and the length of the arm should be compared with the direction of the injury. Ascertain whether the right or left arm has been used, and as the former is most commonly employed, the direction should correspond with it, and be from right to left.

When a wound is alledged to have been committed by accident, we may enquire into the probability of this, by comparing the stature of the body with the person who caused the accident, and thus ascertain

whether the wound could have been received in its existing direction. The place where the accident has happened, and a comparison of the instrument used with the injury inflicted, may also give useful light.

When a person is found dead at the foot of a precipice, or appears to have fallen from any height, we should naturally expect, that fractures, irregular wounds and contusions would be present.

Madmen and suicides, it must be remembered, often inflict the most painful and extraordinary wounds on themselves. In suspected cases, we should ascertain the previous history of the deceased, his state of mind, and worldly situation. The countenance should also be noticed. In suicides, it is usually haggard, the eyes are sunk, and this physiognomy continues while a spark of vitality remains in the body. Those, on the contrary, who are the victims of assassination, have a degree of paleness and fear imprinted on their visage.*

These directions, though they may appear minute, are notwithstanding important, in consequence of the difficulty of the subject, and the fact that there is scarcely any description of wound which may not be inflicted by an individual on himself. Some, however, may be excepted, as when a person has been wounded by a small and sharp-pointed instrument in the spinal marrow, and generally indeed all wounds from behind.

Fire-arms are frequently used as an instrument of death, and here some inference may be drawn from the nature of the wound. If the ball has passed through the body, it is probable that the murderer was near, or that the individual inflicted it on himself. We cannot, however, rest much on this fact. The direction is of more importance: "It may be taken for granted," says Dr. Smith, "that if the weapon has been introduced into the deceased's mouth, and there discharged, it has not been done by another."

* Foderè, vol. 3, p. 181 to 188.

Collateral circumstances will also throw some light. Two cases have lately happened, the one in England, and the other in France, where the wadding was examined, and discovered to have been torn from paper found in the possession of the murderer.* Again, a man was found shot, and his own pistol lay near him, from which circumstance, (and no person having been seen to enter or leave the house of the deceased,) it was concluded that he had destroyed himself; but on examining the ball by which he had been killed, it was found too large ever to have entered that pistol: in consequence of which discovery, suspicion fell upon the real murderers.† Authors have also mentioned the discoloration of the fingers from the combustion of the powder in the pan, as a mark of suicide, and it is certainly an important sign, but a crafty assassin might also have recourse to it.‡

A few cases will form the best commentary on the remarks now made.

On the 8th of February, 1792, S. D. aged about thirty years, and of a robust constitution, became intoxicated at an inn near Morges in Switzerland, and in a room heated very warm by a German stove. At eleven o'clock at night, he left this place quite drunk, in order to return home, which was at the distance of half a league. The weather was cold, and the ground covered with snow. The next morning this man was found dead at the side of a ditch, within a small distance from his dwelling. A report soon circulated that he had been assassinated, and a medical man, who saw the body, asserted the certainty of it. The supposed murderer was already pointed out, when Dr. Desgranges, who then resided at Morges, was ordered to inspect the body.

No traces of injury were found, nor indeed any contusions, until in turning the head from the left to the right side, an oblique wound, about three-quarters of an inch externally, was discovered, situated

* Smith, p. 280, 281.
† Male, p. 180.
‡ Smith, p. 281.

below the under jaw, and nearly at the top of the larynx. On introducing the little finger into this aperture, its size internally was found greater than its external appearance indicated. Its depth was about one inch, and extended to the œsophagus and top of the trachea. The clothes of the deceased were stained with blood, as was also the snow on which he lay.

As the wound which presented itself did not resemble any inflicted by ordinary instruments, Dr. Desgranges was led to the opinion, that the injury was caused by a kind of auger which the deceased had taken with him from the tavern, and which he had held under his arm, with the handle backwards. This was found laying at the side of the man, covered with clotted blood. The truth of the conjecture was confirmed by opening the wound, and putting the auger into it, when it was found to apply completely. On further dissection, it was ascertained that the left carotid had been wounded, and that hence the immediate cause of death had been the hæmorrhage from it. These facts seemed to decide the question as to its being an accident, and it was also supposed, that in endeavouring to remove the auger on which he had fallen, he had moved it round, and thus made the internal wound larger than the external.*

In 1813, some excitement was caused in England on account of the sudden death of Sellis, a servant of the Duke of Cumberland, and the simultaneous injury received by his Royal Highness. Sir Everard Home published a declaration on this subject, which seems to indicate that Sellis committed suicide, after attempting the life of the Duke. "I visited the Duke," says Sir Everard, "upon his being wounded, and found my way from the great hall to his apartment, by the traces of blood which were left on the passages and staircase. I found him on the bed, still bleeding—his shirt deluged with blood, and the

* Foderè, vol. 3, p. 190. The case was communicated by Dr. Desgranges.

coloured drapery above the pillows sprinkled with blood from a wounded artery, which puts on an appearance that cannot be mistaken by those who have seen it. This could not have happened, had not the head been laying on the pillow when it was wounded. The night ribbon, which was wadded, the cap, scalp and skull, were obliquely divided, so that the pulsations of the arteries of the brain could be distinguished. While dressing these wounds, a report came that Sellis was dead. I went to his apartment—found the body laying on his side on the bed, without his coat and neckcloth—the throat cut so effectually, that he could not have survived a minute or two. The length and direction of the wound was such as left no doubt of its being given by his own hand : *any struggle would have made it irregular.* He had not even changed his position—his hands lay as they do in a person who has fainted ; they had no marks of violence upon them—his coat hung upon a chair, out of the reach of blood from the bed—the sleeve, from the wrist to the shoulder, was sprinkled with *blood quite dry, evidently from a wounded artery,* and from such kind of sprinkling, the arm of the assassin of the Duke of Cumberland could not escape."*

Having mentioned a case of accident, and another of probable suicide, I will now state one of homicide. The case was found reported among the papers of Sir John Maynard, an eminent English lawyer, and is stated by him to have occurred in the fourth year of Charles I. It happened in Hertfordshire.

Jane Norkott was found dead in her bed—her throat cut, and the knife sticking in the floor. Two females and a man slept in the adjoining room, and they deposed, that the night before, she went to bed with her child, her husband being absent, and that no person after that time came into the house. The coroner's jury gave a verdict of *felo de se.* But a suspicion being excited against these individuals, the

* Edin. Ann. Register, vol. 6, part 2, p. 19. Smith, p. 284.

jury, whose verdict was not yet drawn up in form, desired that she might be taken up; and accordingly, *thirty days* after her death, she was taken up, and the jury charged them with the murder. They were tried at the Hertford assizes, and acquitted, but so much against evidence, that Judge Harvey let fall his opinion, that it were better an appeal were brought, than so foul a murder should escape unpunished. And accordingly, an appeal was brought by the child against *his father, grandmother, aunt, and her husband Okeman.*

The evidence adduced was, "that she lay in a composed manner in her bed—the bed-clothes not at all disturbed, and her child by her in bed. Her throat was cut from ear to ear, and her neck broke. There was no blood in the bed, saving a tincture of blood on the bolster whereon her head lay, but no substance of blood at all. From the bed's head, there was a stream of blood on the floor, which ran along until it ponded in the bendings of the floor. It was a very great quantity, and there was also another stream of blood on the floor at the bed's foot, which ponded also on the floor to a very great quantity, but no continuance or communication of blood of either of these two places from one to the other, neither upon the bed—so that she bled in two several places; and it was deposed, that on turning up the mat of the bed, there were clots of congealed blood in the straw of the mat underneath. The bloody knife was found in the morning sticking in the floor, a good distance from the bed, but the point of the knife, as it stuck, was towards the bed, and the haft from the bed. Lastly, there was the print of a thumb and four fingers of a left hand.

Sir Nicholas Hyde, chief justice. How can you know the print of a right hand from that of the left in such a case? *Witness.* My Lord, it is hard to describe; but if it please the honourable judge to put his left hand upon your left hand, you cannot possibly place your right hand in the same posture; which

being done, and appearing so, the defendants had time to make their defence, but gave no evidence to any purpose."

The jury brought in all guilty except Okeman, and they were executed, but made no confession.*

Whether these were the guilty persons or not, it is certainly proved most incontestably that the female was murdered.

The Earl of Essex was committed to the Tower on the 10th of July, 1683, on a charge of high treason, and on the 13th, was found dead in his chamber, with his throat cut. A coroner's jury was summoned, but before they were impanneled, the Earl's body was taken out of the closet where it lay, and stript of its clothes. These were carried away, and the closet washed. And when one of the jury insist-

* Hargrave's State Trials, vol. 10, appendix No. 2, p. 29. The above, however, are not the only remarkable circumstances in this case. "Because the evidence," says Sir John Maynard, "was so strange, I took exact and particular notice, and it was as follows: An ancient and grave person, *minister to the parish where the fact was committed*, being sworn to give evidence, according to custom, deposed, "That the body being taken up out of the grave, thirty days after the party's death, and lying on the grass; and the four defendants being present, were required each of them to touch the dead body. Okeman's wife fell upon her knees, and prayed God to show tokens of her innocency. The appellant did touch the dead body, whereupon the brow of the dead, which before was of a livid and carrion colour (in terminis, *the verbal expression of the witness,*) began to have a dew or gentle sweat arise on it, which increased by degrees, till the sweat ran down in drops on the face; the brow turned to a lively and fresh colour; and the deceased opened one of her eyes, and shut it again, and this opening the eye was done three several times. She likewise thrust out the ring or marriage finger three times, and pulled it in again, and the finger dropped blood from it on the grass." *Sir Nicholas Hyde*, chief justice, seeming to doubt the evidence, asked the witness, Who saw this besides you? *Witness.* I cannot swear what others saw. But, my Lord, (said he) I do believe the whole company saw it, and if it had been thought a doubt, proof would have been made of it, and many would have attested with me. Then the witness, observing some admiration in the auditors, spake further, "My Lord, I am minister of the parish, and have long known all the parties, but never had occasion of displeasure against any of them, nor had to do with them, or they with me; but as I was minister, the thing was wonderful to me. But I have no interest in the matter, but as called upon to testify the truth, and this I have done" [This witness was a very reverend person, as I guessed, of about seventy years of age. His testimony was delivered gravely and temperately, to the great admiration of the auditory.] Whereupon, applying himself to the chief justice, he said, "My Lord, my brother here present, is minister of the next parish adjacent, and I am sure saw all done that I have affirmed" Therefore that person was also sworn to give evidence, and did depose in every point—"the sweating of the brow—the change of the colour—thrice opening the eye—the thrice motion of the finger, and drawing it in again." Only the first witness added, that

ed upon seeing his clothes, the coroner was sent for into another room, and upon his return, told the jury *it was my Lord's body, and not his clothes, they were to sit upon.* Before the jury, two surgeons, Sherwood and Andrews, deposed as to the wound. Sherwood stated, that the aspera arteria and the gullet, with the jugular arteries, were all divided. Andrews said, that the throat was cut from one jugular to the other, and through the windpipe and gullet into the vertebræ of the neck, both jugular veins being divided. The verdict of the coroner's jury was in the following words :—That with a razor, "the Earl of Essex gave himself one mortal wound, cut from one jugular to the other, and by the aspera arteria and the windpipe to the vertebres of the neck, both the jugulars being thoroughly divided : and of this he died."

One Laurence Braddon shortly after, formed the opinion that the Earl of Essex had been murdered, and (as he afterwards stated,) conceived it to have been accomplished by individuals who were allowed to pass by the earl's keepers. These murderers he supposed, were set on by the Duke of York, afterward James the II. He was tried for a misdemeanor in suborning witnesses, to prove this, and was found guilty and fined £2000. After the revolution, in 1690, he published a pamphlet entitled, "*The*

he himself dipped his finger in the blood which came from the dead body, to examine it, and he swore he believed it was blood. I conferred afterwards with Sir Edward Powell, barrister at law, and others, who all concurred in the observation. And for myself, if I were upon oath, can depose, that these depositions (especially the first witness) are truly reported in substance." Ibid. p. 29.

In the trial of Standsfield for the murder of his father, (see p. 46 of this chap.) a similar charge was brought. It is stated, that when the son was assisting in lifting the body of his father into the coffin, it bled afresh,and defiled all his hand. The opposite lawyers observe, that "this is but a superstitious observation, without any ground either in law or reason. Carpzovius says he has seen a body bleed in the presence of one not guilty, and not bleed when the guilty were present." They assign, with great probability, as the cause of this bleeding, the fact that the surgeons had made an incision about the neck, and that the motion of the body in removing it, caused the fresh hæmorrhage from that part. Hargrave, vol. 4, p. 283.—I will refer those who are curious on this subject, to Metzger, p. 328; and Valentini Novellæ, App. 3. *De stillicidio sanguinis in hominis violenter occisi, cadavere conspicui, an sit sufficiens præsentis homicidæ indicium?*

earl of Essex's innocency and honor vindicated," which contains some additional particulars.

The closet was about three feet two inches wide, and there was no blood higher than the floor. The instrument itself was a French razor four and a quarter inches in its blade, and no spill or tongue at the end. Hence it must have been held by the blade, and it would seem difficult to inflict so large a wound with it. A surgeon is stated to have suggested to the coroner's jury, *that the notches in the razor were made by my lord against his neck bone.* Lord Essex was right handed and the razor lay on the left side. Two witnesses swore that the neck of his cravat was cut in three pieces, and there were five cuts on his right hand.

Bishop Burnet is of opinion, that the earl committed suicide. He observes, that "when the body was brought home to his own house, and the wound was examined by his own surgeon, he said to me, it was impossible that the wound could be as it was, if given by any hand but his own. For except he had cast his head back and stretched up his neck all he could, *the aspera arteria must have been cut.*" Both the jugulars and gullet (he adds) were cut just above the aspera arteria.

The reader will notice the discrepancy between this account, and the statement given under oath by the surgeons before the coroner's jury.

This subject was also agitated for some time before a committee of the house of lords, and several physicians and surgeons, who were examined before them declared, "that they would not positively say that it was impossible for my lord to cut his throat through each jugular vein, the aspera arteria and gullet, to the very neck bone, and even behind each jugular vein on each side of the neck, (as some judicious surgeons who had viewed the throat had reported it to be cut,) but this they would be very positive in, that they never saw any man's throat so cut, which was cut by himself. And they did then further declare,

that they did believe, that when any man had cut through one of his jugular veins and the gullet and windpipe, and to the very neck bone, nature would thereby be so much weakened by the great effusion of blood and animal spirit, that the *felo de se* would not have strength sufficient, to cut through and behind the other jugular, as my lord's throat, by surgeons who saw it, was said to be cut."

Bishop Burnet relies on some doubtful expressions used by the earl, as a proof that he intended to destroy himself, but it would certainly seem from a review of the above facts, that the earl had been murdered.*

I will close this section with a case of death by fire arms.

C. D. residing in the same house with his sister-in-law, suddenly disappeared. After a course of judicial researches, his body was found buried in a cemetery, wrapped in ten folds of linen, and with his clothes on, covered with blood. In his left side were two round holes, distant about five inches from each other.—The medical examiners reported that one of these penetrated from side to side, so as to take off a part of the right breast, and on pursuing the dissection, the ball was found to have entered at the last true rib of the left side, to have passed the stomach of which it wounded the upper part, and to have pierced the duodenum with a wound five inches long, and finally to have passed out at the first false rib of the left side. Corresponding holes were found in the clothes and shirt, and they therefore gave it as their opinion, that these wounds had been inflicted by fire arms, and were the cause of death. On this, the sister-in-law of the deceased was arrested, as the clandestine burial,

* The authorities from which I have drawn the above narrative, are :— *The Trial of L. Braddon*, in Hargrave's State Trials, vol. 3, p. 855. *The Earl of Essex's innocency and honour vindicated, by L. Braddon.* Ibid. vol. 3, p. 899 to 934. The Republick of Letters for August, 1735. "*Some passages sent by a person of honour to the author of the Republic*," &c. Burnet, vol. 2, p. 212 and 234; and Smith, p. 282 and 283. There is also another pamphlet by Braddon, (published in 1725,) reprinted in Howell's State Trials, vol. 9, p. 1229.

together with the wrapping up of the body, led to doubts concerning her innocence.

Mr. Pelletan, and another surgeon, whose name is not mentioned, were consulted on the case. They agreed, that no doubt could exist as to the cause of the death being a wound from a fusee; but they at the same time affirmed, that the deceased might have inflicted it, either voluntarily or involuntarily on himself, and that another person could not have done it without being in an ambuscade, with his knee on the ground, and the deceased walking. From these circumstances, they were of opinion that the sister-in-law was not the murderer, if murder had been committed.

On this decision, I may remark with Foderè, that it seems difficult that a wound inflicted in this manner, and nearly in a horizontal line, could have been caused by suicide; while again, the sister-in-law, though not the actual murderer, might notwithstanding have been an accessary. She was, however, acquitted.*

8. *Of persons found burnt to death.*

The same circumstances to which we have directed the attention of the examiner in previous sections, are to be noticed in cases of this nature. Dissection, if it be practicable, must not be omitted.

There is an instance related by Foderè which presents a most instructive lesson. In 1809, a wretch murdered several individuals with an axe, and then set fire to the house. The medical officer did not deem it worth while to examine the bodies, and certified that their death was owing to the fire. Meanwhile an individual was discovered murdered about one hundred paces from the house, and suspicion being excited, the bodies were disinterred. It was found that the flames had only burnt the flesh superficially, and that the marks of the axe were still distinctly visible.†

* Pelletan, vol. 1, p. 306 to 323. Foderè, vol. 3, p. 199.
† Foderè, vol. 3, p. 18.

There is one question that may arise in cases where persons are found burnt to death, which is alike interesting and curious; and that is, *can there be such a thing as* SPONTANEOUS COMBUSTION IN THE HUMAN BODY? Several cases are recorded of this nature which I shall relate, and leave the reader to form his own opinion concerning their value.*

It is stated, in the transactions of the Copenhagen society, that in 1692, a woman of the lower class, who for three years had used spirituous liquors to such excess that she took no other nourishment, having sat down one evening on a straw chair to sleep, was consumed in the night time, so that next morning no part of her was found but the skull, and the extreme joints of the fingers. All the rest of her body was reduced to ashes.†

The Countess Cornelia Bandi of Cesena, in Italy, aged 62, and in good health, was accustomed to bathe all her body in camphorated spirits of wine. One evening, having experienced a sort of drowsiness, she retired to bed, and her maid remained with her till she fell asleep. Next morning, when the girl entered to wake her mistress, she found nothing but the remains of her body in the most horrible condition. At the distance of four feet from the bed, was a heap of ashes, in which the legs and arms were alone untouched. Between the legs lay the head. The brain, together with half the posterior part of the cranium, and the whole chin, had been consumed; three fingers were found in the state of a coal, and the rest of the body was reduced to ashes, which, when touched, left on the fingers a fat, fœtid moisture. A

* Probably the term *spontaneous* is not strictly accurate, since we always find some burning body mentioned as exciting the phænomenon in question. I have adopted it, because of its general use, and also because the term *human combustion*, which it has been proposed to substitute in its place, appears too indefinite.

† See an article in the Emporium of Arts and Sciences, edited by J. R. Coxe, M. D. vol. 1, p. 161, entitled, "*On the combustion of the human body, produced by the long and immoderate use of spirituous liquors*, by Pierre Aime Lair." This essay was originally written in French. In my further quotations from it, I shall, for brevity, use the word *Lair* only.

small lamp which stood on the floor, was covered with ashes, and contained no oil; the tallow of two candles was melted on a table, but the wicks still remained, and the feet of the candlesticks were covered with moisture. The bed was not deranged, the bed clothes and coverlid were raised up, and thrown on one side, as is the case when a person gets up. The furniture and tapestry were covered with a moist kind of soot, of the colour of ashes, which had penetrated into the drawers, and dirtied the linen.

This case is related by Bianchini, and confirmed by other writers.*

Grace Pett, the wife of a fishmonger of the parish of St. Clement, Ipswich, aged about sixty, had contracted a habit, which she continued for several years, of coming down from her bed-room every night, half dressed, to smoke a pipe. On the 9th of April, 1744, she got up from bed as usual. Her daughter, who slept with her, did not perceive that she was absent till next morning, when she awoke. Soon after this, she put on her clothes, and going down into the kitchen, found her mother stretched out on her right side, with her head near the grate. The body was extended on the hearth, with the legs on the deal floor, and it had the appearance of a log of wood consumed by a fire, without apparent flame. On beholding the spectacle, the girl ran in great haste, and poured over her mother's body some water, to extinguish the fire. The fœtid odour and smoke which exhaled from the body, almost suffocated some of the neighbours who had hastened to the girl's assistance. The trunk was in some measure incinerated, and resembled a heap of coals covered with white ashes. The head, the arms, the legs and the thighs, had also participated in the burning. This woman, it is said, had drank a large quantity of spirituous liquor, in consequence of being overjoyed to hear that one of her daughters had returned from Gibraltar. There was

* *Lair*, p. 162, who quotes the Annual Register for 1763. See also Phil. Transactions, vol. 43, p. 447.

no fire in the grate, and the candle had burnt entirely out in the socket of the candlestick, which was close to her. There were also found near the consumed body, the clothes of a child, and a paper screen, which had sustained no injury from the fire. Her dress consisted of a cotton gown.*

Le Cat relates the following case, which was communicated to him by M. Boinneau, cure of Plerguer near Dol. It occurred in 1749. Madame De Boiseon, eighty years of age, who had drank nothing but spirits for several years, was sitting in her elbow-chair before the fire, while her waiting-maid went out of the room for a few moments. On her return, seeing her mistress on fire, she immediately gave the alarm, and some persons having come to her assistance, one of them endeavored to extinguish the flames with his hand, but they adhered to it, as if it had been dipped in brandy, or oil on fire. Water was brought and thrown on her, yet the fire appeared more violent, and was not extinguished till the whole flesh had been consumed. Her skeleton, exceedingly black, remained entire in the chair, which was only a little scorched—one leg only, and the two hands, detached themselves from the rest of the bones. It is not known whether her clothes had caught fire by approaching the grate, but she was in the same place in which she sat every day—there was no extraordinary fire, and she had not fallen.†

By a letter from Gen. William Shepherd, it appears, that on the 16th of March, 1802, in one of the towns of the state of Massachusetts, the body of an elderly woman disappeared in the space of about one hour and an half. Part of the family had retired to bed, and the rest were gone abroad. The old woman remained awake to take care of the house. Soon after one of the grand-children came home, and discovered the floor near the hearth to be on fire. An alarm was given—a light brought, and means taken

* Philosophical Transactions, vol. 43, p. 463
† Lair, p. 168.

to extinguish it. While these things were doing, some singular appearances were observed on the hearth and contiguous floor. There was a sort of greasy soot and ashes, with remains of a human body, and an unusual smell in the room. All the clothes were consumed. The fire had been small.*

* Coxe's Emporium of Arts, vol. 1, p. 326, who quotes from Tilloch, vol. 14, p. 96. The same case is also mentioned by Foderè, vol. 3, p. 208.—I have cited the cases in the text, not so much with reference to their peculiar features, as their geographical position. There is a case respectively from Denmark, Italy, England, France, and America. Several other instances are on record, to which I refer the reader for further details. They are,

1. Mary Clues, aged fifty, at Coventry, (Eng.) Phil. Trans. vol. 64, p. 340.
2. An anonymous case, by Vicq D'Azyr, of a woman aged fifty years.
3. A case by Henry Bohanser, of a female at Paris.
4. The wife of Sieur Millet, at Rheims, in 1725, related by Le Cat.
5. Mary Jauffret, at Aix in Provence, related by Muraire, a surgeon, in the *Journal de Medicine.*
6. Mademoiseile Thuars, at Caen, in 1782, related by Merille, a surgeon, in the *Journal de Medicine.*
7. Two anonymous cases of females at Caen.

All these are mentioned by Lair:

8. An anonymous case of a female at Paris in 1779. Foderè, vol. 3, p. 207.
9. The Priest Bertholi, in 1776, in Italy. This is a very remarkable case, and some particulars mentioned by Battaglia, the surgeon who attended him, may with propriety be added in this place. Bertholi was travelling about the country, and at evening arrived at the house of his brother-in-law. He immediately desired to be shewn to his apartment, and when brought to it, requested that a handkerchief should be placed between his shirt and shoulders. This was done, and he was left to his devotions. A few minutes had scarcely elapsed, before a noise was heard in his room, and the cries of the priest were particularly distinguished. On entering the room, he was found extended on the floor, and surrounded by a light flame, which receded as they approached, and finally vanished. On the next morning, M. Battaglia was called, and examined the patient. He found the integuments of the right arm almost entirely detached from the flesh, and between the shoulders and thighs, the integuments were injured. There was a mortification of the right hand, and this, in spite of scarification, rapidly extended itself. The patient complained of burning thirst, and was horribly convulsed; he passed by stool putrid bilious matter, and was exhausted with continual vomiting, accompanied with fever and delirium. On the fourth day, after two hours of comatose insensibility, he expired; and a short time previous to his death, M. Battaglia observed with astonishment, that the body exhaled a most insufferable odour—worms crawled from it on the bed, and the nails had become detached from the left hand.

The account of the patient was, that he felt a stroke like the blow of a cudgel on the right hand, and at the same time, saw a bluish flame attack his shirt, which was immediately reduced to ashes, the wristbands in the mean while remaining totally untouched. The handkerchief between the shoulders and shirt was entire, and free from any trace of burning. His breeches were also uninjured, but though not a hair of his head was burnt, yet his cap was entirely consumed. There was no fire in the room, except that the lamp, which had been full of oil, was now dry, and its wick reduced to a cinder. Foderè, vol. 3, p. 210. Lon. Med. Repository, vol. 1, p. 332.

10. A female at Paris in 1804, aged 68, related by Dr. Vignè. Foderè, vol. 3, p. 216.

Some deductions are drawn from these cases, by Drs. Lair and Marc, which it is proper to mention. 1. The subjects were nearly all females—and they were far advanced in life. The Countess of Cesena, was 62, Mary Clues 52, Grace Pett 60, Madame de Boiseon 80, and M. Thuars more than 60. 2. Most of the individuals had for a long time made an immoderate use of spirituous liquors, and they were either very fat or very lean. 3. The combustion occurred accidentally, and often from a slight cause, such as a candle, a coal, or even a spark. 4. The combustion proceeded with great rapidity, but the extremities, such as the feet and the hands, were generally spared by the fire. 5. Water, instead of extinguishing the flames which proceeded from the parts on fire, sometimes gave them more activity. 6. The fire did very little damage, and often did not affect the combustible objects which were in contact with the human body at the moment when it was burning. 7. The combustion of these bodies left as a residuum, fat fœtid ashes, with an unctuous, stinking and very penetrating soot. 8. The combustions have occurred at all seasons, and in northern, as well as southern countries.*

As to the cause of these phœnomena, two opinions have been promulgated. Lair and others suppose that there is an alkoholic impregnation of the body, and that actual contact with fire is then necessary to produce them; while Maffei, Le Cat, Kopp

11. A female in France, aged 28, communicated by Dr. Prouteau, in *Leroux's Journal de Medicine*. New-England Journal, vol. 4, p. 194.

12. Mrs. Laire, at Saulieu, in 1808, aged 60 years. Ballard, p. 414.

13. Ignatius Meyer, aged 48, in the village of Waertelfeld, bailiwick of Schwalenberg in Germany. This occurred on the 17th of January, 1811. Meyer was a very intemperate man. The parts of the body under the bedclothes were not affected. This case is related by Dr. Scherf of Detmold. London Med. Repository, vol. 3, p. 239. New-York Medical Repository, vol. 18, p. 87.

14 & 15. Two cases are said to have lately occurred in France. Smith, p. 60. They may possibly be Nos. 10 and 11.

If to these we add the five cases mentioned in the text, we shall have at least eighteen cases that are recorded of this extraordinary phænomenon; and there are doubtless several which I have not noticed.

* Lair, p. 171. Foderè, vol. 3, p. 217. Belloc, p. 194.

and Marc attributes this combustion to the agency of the electric fluid.*

There is but one instance on record, that appears to have been made the subject of judicial enquiry, although it is evident that all might lead to suspicion, and even condemnation.

The case is related by Le Cat, and is that of the wife of the Sieur Millet, at Rheims. She got intoxicated every day, and the domestic economy of the house was managed by a handsome young female. This woman was found consumed on the 20th of February, 1725, at the distance of a foot and a half from the hearth in her kitchen. A part of the head only, with a portion of the lower extremities and a few of the vertebræ, had escaped combustion. A foot and a half of the flooring under the body had been consumed, but a kneading trough and a tub, which were very near the body, sustained no injury. M. Chretien, a surgeon, examined the remains of the body with every juridical formality. Jean Millet, the husband, being interrogated by the judges, declared, that about eight in the evening of the 19th of February, he had retired to rest with his wife, who not being able to sleep, had gone into the kitchen, where he thought she was warming herself; that having fallen asleep, he was awakened about two o'clock by an infectious odour, and that having run to the kitchen, he found the remains of his wife, in the state described in the report of the physicians and surgeons. The judges formed an opinion, that he had conspired with his servant to destroy the wife, and he was condemned to death. On appeal however to a higher court, this decree was reversed, and it was pronounced a case of human combustion, but his health and fortune were irreparably destroyed, and he died in a hospital.†

* A valuable paper on this subject is published in the American Medical Recorder, vol. 5, p. 489, by Thomas D. Mitchell, M. D. The ingenious author supports, in a very satisfactory manner, the opinion, that combustible gases are generated in the system of drunkards, by the decomposition of the alcohol which is continually drank.

† Lair, p. 167. Foderè, vol. 3, p. 205.

The distinction then between these cases, if we allow their possibility (and I cannot well see how we can avoid this) and ordinary combustion, is, that in the latter, if the body be not wholly consumed, there will be redness, blisters, scars, &c. on various parts. The combustion will be incomplete, particularly as to the bones, and it will extend itself more certainly to neighbouring substances—it is evidently, also slower in producing its effects.*

9. *Of persons found dead from hunger.*

The crime of permitting or causing individuals to die from hunger, is no doubt rare in civilized countries. Instances have however happened, and an account of the appearances observed after death, is therefore proper.

The body is much emaciated, and a fœtid, acrid odour exhales from it, although death may have been very recent. The eyes are red and open. This appearance is uncommon from other causes of death. The tongue and throat are dry, even to aridity, and the stomach and intestines are contracted and empty. This last mark has been repeatedly noticed. Haller dissected the body of a person who destroyed himself by hunger, and found the organs in question entirely empty. Not the least vestige of fæces was to be seen in the intestines. The gall-bladder is puffed with bile, and this fluid is found scattered over the stomach and intestines, so as to tinge them very extensively. The lungs are withered, but all the other organs are generally in a healthy state. The blood vessels are usually empty.

There is considerable variety as to the rapidity of putrefaction in these cases. With many, it occurs to a high degree, immediately after death, while with others, it is delayed longer than in ordinary cases.†

* Belloc, p. 195.

† Foderè, vol. 2, p. 276. Ibid. vol. 3, p. 231 to 239. These appearances are confirmed by the observations of Morgagni, Redi, Valsalva, and Haller, as quoted by our author. There is also a case mentioned in the London

We may remark that several of the signs as now related, are characteristic and distinct from those occurring from other causes of violent death, and I would particularly refer to the healthy state of particular organs, the peculiar redness of the eyes, the state of the stomach and intestines, and the great secretion of bile.

In 1768, the daughter of a notary at Nevers, in France, aged fifteen, died of an unknown disease. She had been already buried, when it was rumoured abroad that her father had caused her death by hunger in a cellar. The information laid before the judge was of such a nature, that he directed the arrest of the parent, and the disinterment of the body. This was twenty-four hours after the burial. The report of the medical examiners was as follows :

The whole body is extremely emaciated. The skin is very thin, and its colour livid—an unpleasant odour is exhaled—the eyes are open and red—contusions and excoriations appear on various parts of the body—and the anus and vagina are covered with small white worms in great quantity, and these parts, and particularly the first, are much excoriated and dilated. On opening the body, the stomach was seen in a healthy state, containing a wine glass full of serous, greenish bile—the pylorus was contracted—the duodenum, together with the right side of the ileon and jejunum, was inflamed—the gall-bladder was swelled with bile, and the intestines were entirely empty. The remainder of the viscera, together with those of the thorax and head, were in a healthy state, except that the right lung was a little withered. The report concluded by giving an opinion, that the girl had died in a state of extreme weakness and languor, but it assigned no cause for it.

Med. and Phys. Journal. vol. 15, p. 510, of death from spontaneous abstinence, which occurred under the observation of Dr. Desgenettes at Paris, where the appearances on dissection were nearly precisely similar to those mentioned above, except that the lungs were sound. *The stomach was reduced to a fourth of its natural size. The gall-bladder was distended with bile, and the duodenum, and other smaller intestines, were filled with that fluid.*

Public opinion continued to implicate the parents, and they sought a defender in the celebrated Petit, from whom an answer to the following questions was requested : 1. Whether the facts stated above were sufficient to prove that the child died from hunger ? 2. Whether there was any circumstance to indicate that a length of time had elapsed between the death and burial ? To both of these, he answered in the negative, and for the following reasons : Extreme emaciation is rather a proof of long illness, than of starvation, because it is very common for persons of a tolerable degree of fatness, when they refuse food, to die before they lose much flesh. The emptiness of the intestines was more indicative of colliquative diarrhœa from long disease, than of any other cause. The state of the gall-bladder proved, (in Petit's opinion) nothing on one side or the other, nor did the excoriations. while the natural state of the stomach was an argument against death by famine, since in such cases, that organ is observed to be much contracted. Finally, the worms might have been present in the parts for some time before death, nor was the smell of the body by any means so offensive as to indicate putridity of long standing. On these grounds, though unwilling to assign a cause of death, he was decidedly of opinion that famine had not induced the fatal termination.

It is impossible to read this opinion, and compare it with the observations of able anatomists on persons known to have died from hunger, without agreeing with Foderè, that Petit appears rather as the advocate of the accused, than the partial investigator of truth.

On the trial, it was conclusively proved, that the parents had been guilty of mal-treatment, and though after the opinion of Petit, their lives could not be affected, yet the father was sentenced to the gallies for life, and the mother to perpetual banishment.*

* Foderè, vol. 3, p. 223 to 231

CHAPTER II.

WOUNDS ON THE LIVING BODY.

1. Of wounds in general—duration of them—slight—dangerous, and mortal. Notice of each. Circumstances which may aggravate the danger of wounds—The age and constitution of the patient, and his maladies—his passions—negligence or delay—insalubrity of the atmosphere—ignorance or unskilfulness of the surgeon. 2. Nature and prognostics of wounds of particular parts—Wounds of the head—of the face—of the neck—of the thorax—of the abdomen—of the extremities. Laws as to the time within which death from wounds is deemed murder. 3. Of mutilation—French laws against it—English—American—English Coventry act. Cases under it.

It has been already stated, but it is proper to repeat in this place, that the term WOUND, in legal medicine, comprehends all lesions of the body, and in this it differs from the meaning of the word when used in surgery. The latter only refers to a solution of continuity, while the former comprises not only these, but also every other kind of accident, such as bruises, contusions, fractures, dislocations, &c. &c. In this sense then the term is to be understood in our future remarks.*

The questions which arise in all cases of wounds that come under judicial investigation, are the following: How far has the person who caused the injury, contributed to the death of the deceased, or to the lesion of one or other of the functions of the body? And again, to what class is a certain wound to be referred? These are enquiries of great magnitude—and correct views, as well as stable principles, are needed in order to answer them properly. Medical and surgical works are filled with instances of remarkable recoveries from the most dreadful wounds, and also with cases of death from apparently the slightest ones. If we take these as our guide, the

* Ballard, however, objects to this, and recommends the word LESION, for the general term. Page 313.

consequence will be, that nothing of a determinate nature can be agreed upon, and every physician, whenever he enters a court of justice, may, by the aid of a corresponding example, prove that a dangerous wound is not so, and that its fatality has been owing to ignorance or neglect. Such power is too extensive and too important to be granted to every medical witness, and whatever we take from his hands, and refer to sound principles and general rules, is a solid gain to the cause of truth and justice.

In further proceeding with my observations, I shall in the first place, notice the subject of wounds in general, and afterwards examine the nature and prognostics of wounds of particular parts. The subject of mutilation, from its entering so much into our statute law, will form a third section.

1. *Of wounds in general.*

Wounds, from their nature, may be either *slight*, *dangerous*, or *mortal*. By a slight wound, is meant one in which there are no parts injured that are important to carrying on life, or any of its functions, and whose uniform course is to heal quickly, and to leave no lesion or deformity. A dangerous one, implies a wound which, without being mortal, is still not exempt from danger, and presents more or less difficulty in its cure. Lastly, mortal wounds comprehend those whose consequence and effect is death. In this sense only is a wound in legal medicine termed mortal. More minute divisions than these which I have named, may, however, be made, and indeed are indispensable. Thus, a wound may be in itself mortal, or it may be mortal by accident. It may be in itself dangerous, or it may become so from some complication, or from not having been properly treated. Even slight wounds may become dangerous from neglect, from a debilitated or diseased state of the system, or from mal-treatment, such as endeavouring to excite suppuration, when the aim ought to be to promote adhesion. In such cases, the blame should be laid where it properly belongs.

Circumstances as well as accident have a considerable effect on wounds. Bohn suggests several instances of this nature, in which their mortality is prevented by particular phenomena. Thus, a small portion of the omentum, or the fat of the intestine, may so place itself in the mouth of a wounded blood-vessel in the abdomen, as to prevent a hæmorrhage, while, if not thus obstructed, it would be mortal.* Again, it has been repeatedly observed by surgeons, that there may be such an adhesion of the pleura to the lungs, as that the blood or pus from the latter will flow outwardly, when they have been injured by a penetrating wound. The same author remarks, that it has never been demonstrated, and indeed in the nature of things it never can be proved, that a wound from which there is a recovery, is precisely similar to one which has proved fatal, although externally they may be similar in every respect. In the one case, there can be no dissection to prove its nature, and in the other, there may have been many peculiar circumstances not attendant on the former.† This observation is in itself a sufficient answer to the argument already referred to, of proving the possibility of recovery from dangerous wounds, by a reference to similar instances.

The subject may be farther illustrated by examples. A man, says Bohn, receives a wound in the bottom of his stomach, a severe hiccup, faintings and retchings come on, while the half digested food that he has taken, passes out through the aperture. This individual is, however, cured in a month's time, whilst another, whose wound is accompanied with similar symptoms, except that he does not hiccup, and which in itself is a favorable symptom, dies in three days. Shall we say that the latter was not

* Bohn, p. 31. He mentions a dissection, in which the right illiac artery was found wounded, and life had been prolonged for thirteen days, evidently from this cause.

† Bohn, p. 27. "Dubium an vulnus sanatum exacte idem cum non sanato fuerit."

mortally wounded, because the former escaped? Dissection will teach us the incorrectness of this deduction, and that in the instance of mortality, the wound has been rather lateral than deep, and has touched the left gastric artery, in consequence of which, there has been a profuse hæmorrhage into the abdominal cavity. Again, an individual receives a violent blow on the head, which causes a depression of the cranium, and is accompanied with a considerable hæmorrhage from the head and ear, and a loss of sense and motion. After a day or two, the depressed piece of bone is raised, he recovers his senses, the hæmorrhage ceases, and at the end of some weeks, the patient recovers. Another is injured in precisely the same manner, is treated similarly, and notwithstanding, dies at the end of the seventh day, without ever recovering from the state of coma, and on dissection, extravasated blood is found in the ventricles of the brain.*

These instances are sufficient to prove, how little dependence is to be placed on analogy, and they also illustrate the importance of fixed rules concerning the mortality of wounds, founded exclusively on anatomical and physiological data.

A strict definition of life is not necessary at this time, and it is sufficient to state, that it depends on the union and reciprocal influence of the functions which compose it, and particularly of the circulating, nervous and respiratory systems. Lesions of the chylopoetic system come next in order, as the body cannot survive without nourishment, and the danger to life will of course be in proportion to the extent of the injury, and the immediate necessity of the organ. Wounds which rupture the large blood vessels in one or other of the large cavities, such as the head, the thorax, or the abdomen; those which penetrate the auricles or ventricles of the heart, the trunk of the aorta, or vena cava, are irrecoverably *mortal*. There

* Bohn, p. 28, 29.

are, however, so many cases on record, in which individuals are stated to have survived for some time, with large abscesses in the brain, or even a ball in that part, that we are justified in viewing wounds of the heart more fatal than those of the head. Next to these are wounds, which, from their depth, penetrate into the spinal marrow—wounds of the head, complicated with such severe injury, that venesection and the trephine do not alleviate them—a division or twisting of the spinal marrow in the cervical vertebræ—a division of the eight pair of nerves—and a general affection of the nervous system from blows or injuries on parts, which are the centre of its various departments, such as the pit of the stomach. In the next place, may be mentioned as mortal wounds, such as prevent the function of respiration—a total division, or a large wound of the trachea ; and particularly, if in the latter case, the underlip of the wound is retracted inwards—wounds penetrating through the bronchiæ, and wounds of the diaphragm, particularly of its tendinous portion. To this class belong also, extensive wounds of the pharynx, æsophagus, and stomach—of the duodenum, thoracic duct, and mesentery, and particularly, if a large number of the lacteals be divided, together with severe wounds of the liver, spleen, pancreas, gall-bladder, and the ductus cysticus and choledicus. Wounds of the urinary passages, kidneys, ureters, bladder, impregnated uterus and amputation of the male genital organs, are all ordinarily mortal, unless immediate aid be afforded, as are also extensive and penetrating ones from fire arms accompanied with fracture of bones.

All these accidents, from the importance of the organs that are injured—the extravasations that occur, or the hæmorrhage which accompanies them, and which it is often impossible to check, are usually mortal. Such, however, are the powers of nature, and so extensive are its resources, that hope should seldom be abandoned. If called upon to make an

immediate report, it is proper to form a prognostic on these principles, and to mention the danger that is present. On the trial, however, the conviction must be decidedly stated, that the wound was a mortal one, and that no surgical aid could have saved the patient, or when applied, had no beneficial effect.

Among *dangerous wounds*, or those concerning which we cannot give a decided prognostic, must be ranked such as are inflicted on organs essential to the exercise of the vital, natural, or animal functions; and as to their consequences, they may be divided into those which may become mortal, and those which may interrupt the exercise of any function. To the first class belong all penetrating wounds, though unaccompanied with symptoms that indicate immediate danger—all contused wounds, whether on the head, thorax or abdomen—all wounds of the extremities, and particularly where surgical aid cannot be procured in time to suppress hæmorrhage, and all compound fractures and luxations, particularly if the part be much surrounded by nerves and muscles, and if it be near a joint. Even simple contusions or blows may become dangerous, from a rapid disorganization of parts, and a consequent mortification; and especially, if, on tendinous or ligamentous parts, the supervention of tetanic affections are to be dreaded.

In the second class are included all wounds made in any of the secretory organs and their ducts—in the organs of sense, as the eye, ear, nose and mouth—in the generative organs, as the testicles, penis and unimpregnated uterus. Also, fractures of the clavicle or sternum and depression of the xiphoid or ensiform cartilage—transverse wounds of the great pectoral or dorsal muscles—and wounds of the muscles of the abdomen, particularly near the linea alba, and pubis—wounds of the perineum combined with injury to the canal of the urethra, pricking of the tendons of muscles, together with wounds of important branches of nerves.

Slight wounds comprehend those injuries in which

the skin and the muscles are divided, the latter in the direction of their fibres, and where no tendon, aponeurosis, large nerves, or blood vessels are touched and the system has not received a severe shock. To this class, also belong simple luxations and fractures.

But, as we have already observed, these are circumstances which render this division an arbitrary one, and which cause a mortal wound of the lowest class to be inevitably mortal—a dangerous one to become mortal—and a slight one, dangerous. These circumstances may be reduced into four classes, each of which deserve particular notice.

1. The constitution and age of the patient, and his antecedent or coexistent maladies may exercise a baleful influence on the injury received. Thus, for example, there may be a complete transposition of parts—the heart is sometimes found on the right side of the thorax—the spleen has been discovered to occupy the place of the liver—the stomach has descended as low or even lower than the umbilical region, while the bladder has risen into the abdomen. It would certainly be unjust, except in cases of premeditated murder, to consider the criminal as responsible for the fatality of wounds given under such circumstances. Again, an individual may be suffering under hernia, and in that situation, may receive a mortal wound from a cutting instrument, or may die from a contusion or blow on the part, which under other circumstances would not prove dangerous.* The condition of the wounded person may also be rendered hazardous from a variation in the ordinary distribution of blood vessels—from the presence of aneurism—from an extreme thinness of the bones of the cranium† or a venereal caries of the same part—from

* Bohn, p. 70, 71.

† A remarkable case of this description is stated in a late journal. A respectable individual put an end to his existence by hanging himself. Dr. Wesener was directed by the proper officers to examine the body. The examinatio : of the thorax and abdomen presented nothing beyond what is usually observed in such cases, but on opening the head, he found the following deviation from nature. About the middle of the sagittal suture, the

having large umbilical vessels, or finally, from being afflicted with some chronic disease, or suffering under debility. Slight wounds may also be rendered dangerous, and even mortal, from an extreme irritability of the nervous system, from previous habits of drunkenness, or from a scorbutic, cancerous, cachectic or venereal habit.* A case is thus cited by Bohn, of an individual who in a quarrel, received some blows on the chest, and after a short time, was seized with hæmoptysis, severe pain in the side, delirium and convulsions, and finally died. On inspection, a slight discoloration was observed on the back and limbs, while the genital organs were in a state approaching gangrene. The abdominal viscera were healthy, but the lungs and pleura adhered, and the former were filled with thickened pus.† In this instance, there was certainly sufficient of disease present, to have produced death within a very short period, without the intervention of the blows. All the possible circumstances enumerated above, should be kept in view, and particularly, when wounds have been involuntary, or belong to what is termed in law, manslaughter.‡

bones of the cranium were, for the space of a sixpence, as thin as the most delicate lamella of bone, and in this spot were two openings, each about the size of a pin's head, through which two vessels ran, which arose from the superficial veins of the dura mater, and anastamosed with the veins of the scalp. On cutting into the scalp, though with great care, the blood flowed over the galea aponeurotica in such quantities as quite to redden it, and it appeared on examination, that the emissaria Santorini were cut through. It is evident from this statement, that a blow on the spot in question would probably have caused death, either by direct depression, or by causing internal hæmorrhage. Quarterly Journal of Foreign Medicine and Surgery, vol. 2, p. 105, from Hufeland's Journal.

* There are some individuals in whom an alarming hæmorrhage is produced by the slightest abrasion of the skin. Metzger quotes a case of death produced in this way, by a scratch of the thumb-nail. Several relatives had previously died in a similar manner, (p. 327.) See also the New-England Journal. vol. 2, p. 221, for some remarkable cases where this disposition occurred in families. In the Medico-Chirurgical Transactions, vol. 8, p. 224, a case of fatal hæmorrhage from the extraction of a tooth, is related by Mr. Blagden. The coats of the arteries were found, on dissection, very thin, and nearly transparent.

† Bohn, p. 76.

‡ The most difficult cases probably that occur in the medical jurisprudence of wounds, are those where persons in habits of intemperance engage in brawls, receive injuries, and after an uncertain period, die. The

But it may happen, that while the patient is suffering under a wound, he is attacked with disease and dies, and the question then arises, whether this fatality is owing to the wound, or the disease. In some instances, the solution is easy, but in others, it is attended with considerable difficulty. Thus, for example, a fever attended with comatose symptoms may supervene on a wound of the head, and pleurisy may follow a wound of the thorax. The probability evidently in such instances, is, that the injury has produced the disease, but there is notwithstanding, sufficient latitude left for doubt, and circumstances may arise, which will prevent us from assigning the wound as the cause of death. On the other hand, should gangrene, buboes, petechiæ, or the other symptoms of malignant fevers appear on a wounded person, in a hospital, or during the warm season of the year, or during the prevalence of such an epidemic, it would certainly seem that the cause of death is distinct from the danger of the wound. A similar observation will apply when an inflammatory or typhus fever supervenes on slight wounds, and renders them fatal.*

question frequently arises, whether the drunkenness or the blow has caused the loss of life. As a general rule, I would always lean towards the accused. The habitual use of spirituous liquors is so apt to produce a diseased state of the system generally, that unless positive malice be proved, we shall best promote the ends of justice by considering the offence as a secondary one. A case is related by Dr. Klapp, where an individual in Philadelphia, under such circumstances, died thirty-eight hours after the affray. He walked and spoke after it, and even drank part of a pint of spirits, but was shortly seized with insensibility, dilated pupils, oppressed breathing, and died without any return of sense. The bone and the brain beneath the injured part were examined, and found natural. *The mucous membrane of the cardia and the upper part of the stomach, was greatly inflamed*—the other parts were not diseased. Before the court, Drs. Hartshorn and Klapp gave it as their opinion, that the injury to the head had not been the cause of death, and that there was no appearance of a blow on or near the region of the stomach. I fully agree with the verdict of acquittal in this case, but I would suggest whether, in some cases of severe injury to the head, a similar appearance of the stomach may not be produced. I refer for an elucidation of my idea, to Dr. John C. Warren's cases of apoplexy with dissections, in the New-England Journal, vol. 1, p. 34. This anatomist has shown, that not unfrequently a high degree of redness in the mucous coat of the stomach, accompanies cerebral affections. Dr. Klapp's case is related in the American Medical Recorder, vol. 1, p. 156.

* Bohn, p. 83. This author divides the symptoms into three classes.

The following instance, in which Zacchias was consulted, will illustrate the difficulty that may occur. During a period when the plague raged at Rome, one Ansovini received, in a quarrel, a wound on the head, which denuded the bone, but left no fracture. He withdrew by the assistance of two friends, one of whom continued to visit him, but died in four days thereafter of the plague. The wound appeared favourable for the first three days, but at the termination of that period, a fever came on, accompanied with headach, bilious vomiting, and violent inflammation of the wounded part. On the fourth, the wound was gangrenous, and petechiæ and buboes occurred; and on the sixth day, death followed. The person who inflicted the wound, was arrested by the minister of justice, on the ground that it was the cause of death, or at least that it predisposed the individual to the attack of the plague. Zacchias was consulted by the friends of the accused, and he decided that the wound had not been the cause of death, because there were no symptoms immediately after its infliction, that indicated a mortal injury to the head—that the appearances which supervened, were too rapid in their progress to appertain to it, and evidently belonged to the plague, and it was also evident he had taken this disease from the friend who visited him. Finally, two diseases were present in the individual, and the ordinary course of one is fatal, while that of the other is to proceed to a favourable termination. It is certainly proper to assign the former as the cause of death.*

2. The passions of the patient, and his negligence or delay, or that of his attendants, may render slight wounds dangerous, and dangerous ones mortal. This may happen, 1. By his obstinate refusal to undergo

" Alia ex vulnere ipso, ut tali, hanc â parte læsa immediatè emergant; alia aliam extra vulnus causam agnoscant; alia indifferenter se habeant, id est, modo â vulnere, modò aliunde eveniant: probe omnes ac singulæ ponderandæ sunt in vulnerato circumstantiæ, et ex harum demum collatione, cujus generis sint illa individui presentis, prudenter inferendum."

* Zacchias. Consilium, No. 74.

the proper treatment, either from fear or some other cause. 2. From errors in regimen, such as intemperance, from exposure in a very cold or a very warm place, or from giving himself up to the free indulgence of his passions. 3. By disobeying the directions of his physicians, as for example, if a man who has been wounded in the throat, should laugh, talk or sing. 4. By yielding to anger or fear, so far as to tear off the bandages and dressings of the wound. All these circumstances will aggravate an injury, and render it dangerous or mortal.* There are others, which may be deemed accidental causes, such as a want of proper aid, of whatever kind it may be, and from whatever source it may arise. Both of these of course increase the guilt of the criminal, if it can be proved that he inflicted the wound with a knowledge of them. To this class also belong every obstacle opposed to the surgeon's performance of his duty, and all attempts to disturb the patient, such as the prevention of sleep, and producing agitation of mind.

3. Insalubrity of the atmosphere, whether it be of a local nature, or the general constitution, may render slight wounds dangerous, and dangerous ones mortal. This circumstance has been noticed some centuries since, and the experience of every military campaign confirms its correctness. Thus, according to Bohn, Sebezius states that wounds of the head were more readily cured in Italy and Spain, than in Germany, and Foderè mentions his having observed the same on the coast of the Mediterranean, when compared with Paris. Ambrose Parè, a great name in surgery, observes, that at the siege of Rouen, many of the besiegers died of small and simple wounds, in consequence of the unhealthy atmosphere, but which was attributed by the army to poisoned weapons—an idea, which similar effects induced the inhabitants of that city also to harbour.†

Severe cold, excessive heat, storms of rain, snow

* Mahon, vol. 2, p. 28.
† Bohn, p. 78. Foderè, vol. 3. p. 276

or hail, have all been observed to increase the danger of wounds, and for proofs of this, I need only to refer to works on military surgery.

The air of large hospitals has also been found injurious, and it is constantly observed, that a larger proportion die of wounds at the Hotel Dieu at Paris, than in the hospital de la Charitè.* The very name of Hospital Gangrene, is sufficient to apprise us of the extent of the fatality that is sometimes experienced. In such cases, it is the duty of the medical examiner to apply the maxim of Hippocrates, that every thing which happens to the injured person, contrary to correct probability, does not belong to the essence of the disease. Thus, if there is a general or local morbid state of the air, and the most cautious examination proves that the wound had not affected any essential organ, it is his duty to state these facts, and to mention that death has originated from several causes, of which the wound is the slightest, although it may have excited the developement of the others.

4. The ignorance or negligence of the surgeon may aggravate or endanger the condition of a wounded patient.† This happens when futile or injurious medicines or applications have been used—when the instruments employed are in bad order—when the surgeon is either ignorant or rash—or when seeing the danger, he does not obtain the aid of skilful persons. In general, when a dissection proves that no wound mortal in its nature, has been received, and when none of the circumstances already enumerated, can be urged as causing its fatality, the death of the patient should be attributed to the surgical attendant, rather than to the author of the wound, provided that it be proved that he neglected the sick person, or maltreated him, by leaving foreign bodies in the wound, which might have been taken away—by not suppressing hæmorrhage—by not evacuating

* Mahon, vol. 2, p. 25. "Dans certain hôpitaux, et notamment a l'Hôtel Dieu de Paris, le trepan est presque toujours mortel." Metzger, p. 876

† Bohn, p. 93, 96.

collections of pus when necessary—by employing tents improperly—by neglecting or hurrying operations—or by not causing the proper regimen to be observed.*

Notwithstanding the distinctions that have now been made, there are some doubtful and complicated cases, concerning which, great difference of opinion may arise, and the skill of the surgeon often forms the disputed point. To this class most commonly belong wounds of the head, such as those, for example, in which there are no symptoms indicating the necessity of trepanning, and yet extravasation is found after death. The diversity of advice given by eminent surgeons on this point during the last twenty or thirty years, may also lead to unpleasant discussions. But it is the duty of the surgeon to acquaint himself with the most approved modes of modern practice—to apply them to the symptoms presented to his view, and then, if on examination the injury is found to be such that no efforts of art could have prevented its fatality, the death of the patient is to be attributed to the nature of his wound.†

2. *Of the nature and prognostics of wounds of particular parts.*

I shall endeavour to make this section as concise as possible, as it is only intended to be a general guide to the medical examiner. The opinions deducible from it, are subject to many qualifications, which the peculiarities of every case can alone indicate, and they are evidently not to be quoted as universally applicable.

* The laws at a very early period attended to this circumstance. In the Roman code, the *Lex Aquilia* declared, "Si verberatus fuerit servus, non mortifere, negligentiâ autem perierit de vulnerato actio erit, non de occiso.' So also in the ancient French jurisprudence. If negligence or bad treatment was proved, it freed the individual, unless premeditated design was established. Foderè, vol. 3, p. 290, 291. The same principle practically exists in our own judicial determinations.

† The principal authority used in this section, is Bohn—*De Renunc. Vulner. in genere.* Foderè (vol. 2, p. 251 to 294,) and Mahon's (vol. 2, p. 1 to 62) observations, are generally derived from this source.

We shall notice *wounds of the head* in the first place; and here a preliminary remark cannot too soon be made, or enforced, viz. that in no other part is the prognostic more uncertain, nor is there one in which the physician has more occasion for suspending his judgment. The general prognostic of wounds of the head depends on the nature of the injured parts—the age and condition of the patient—the nature of the instrument with which the wound has been inflicted—the force or violence used—the manner in which it was applied, and the effects that followed.

A wound of the integuments of the cranium, if inflicted with a cutting instrument, such as a knife or razor, may be deemed a simple wound, which will heal within the space of a few days. But if the instrument, although a cutting one, is of great weight, and has been projected by a strong arm, we should reserve our prognostic, on account of the subsequent affection of the brain, which may justly be dreaded. If a sharp pointed instrument has been used, and it has penetrated as far as the bone, the inflammation and pain that follow, are more severe than from incised wounds. When a contused wound has been inflicted, as by a stick or stone, the prognostic will depend much on the immediate symptoms, and it will be dangerous in proportion to the dizziness, nausea, insensibility, &c. that are experienced for a short time thereafter. A superficial contusion, accompanied with laceration and none of the above symptoms, may generally be deemed a slight wound. But a contusion however slight on the region of the temporal muscles is scarcely ever exempt from danger, on account of the intimate connection of this part with the brain, by means of its nerves, blood vessels and membranes.

Wounds of the pericranium in good constitutions and well treated, are not dangerous, but in bad ones, they are often serious and are succeeded by an erysipelatous inflammation, which is readily extended to the brain. A complete division of the pericranium

is much less to be dreaded, than a wound from a sharp pointed instrument. In venereal patients, caries of the bone is a frequent consequence of such injuries.

Fracture of the bones of the cranium may take place without any correspondent injury of the integuments, and the symptoms in such cases are extremely equivocal and deceitful. Our deduction must however be drawn from the circumstances that immediately followed the infliction of the wound—from those that afterwards supervene, and from a consideration of the causes producing them. Among the first are vertigo, loss of sense and motion, vomiting, and bleeding from the nose and ears. Among the latter, may be coma, convulsions and paralysis. Fracture may however occur without any of these being present, and again, they may all be present, without any fracture, and result from concussion of the brain. It should be remembered, that fracture accompanied with depression of the bone, is usually more dangerous than when none is present.

Concussion of the brain is always dangerous, as are also all wounds of the brain and its membranes. On these it is not necessary to enlarge at this time. It is however proper to remark, that the prognostic of wounds of the head, is for the most part, that they are dangerous, and require the strictest attention. And this is rendered more necessary, since it has often happened that injurious and even fatal consequences have been produced long after the infliction of the injury, and that too, where the immediate symptoms have given little or no reason for such a termination.*

* The succeeding case will illustrate the difficulties that sometimes envelope the cause of death. "A woman received a blow on the head from a laundress's iron, but no fracture or injury of the cranium was discoverable, though it was thereby laid bare. She was (by the advice of the celebrated Cheselden) trepanned, and still no mark of injury about the cranium was discovered. She went abroad, and followed her ordinary business for a fortnight afterwards; but at the end of twenty days from receiving the injury, died. On opening the head, they found a very large imposthume in the middle of the brain. This occasioned some perplexity

The opinion of the medical examiner, must therefore be founded not only on general principles, but on the symptoms that are present, and when called into a court of justice, he should explain how uncertain the recovery from such injuries always is, and on the other hand, that persons have survived the most terrible accidents. The presence or absence of fever, or delirium or coma, and the healthy or livid appearance of the wound, all aid in determining on the danger. The following aphorisms of the illustrious Vicq d'Azyr, are quoted by French surgeons as comprising the experience of the art on these points, and they are evidently deserving of remembrance. 1. That the largest wounds of the head are not always the most dangerous. 2. That it is possible to lose a considerable quantity of the brain, without death ensuing. 3. That the slightest injuries are often succeeded by fatal consequences, and that hence they should in no case be neglected. 4. That a contusion of the bone alone may gradually extend itself, so as to affect the brain.*

about the real cause of death. The surgeon who had managed the case, was rather inclined to attribute the death to the blow, but would by no means deny that it might have proceeded from some inward cause. The deceased had been subject to frequent and severe headachs, before the accident occurred. Mr. Cheselden being examined on the trial, declared that he could not conceive how a blow should be the cause of death, where there was no extravasation, and the person could go about for a fortnight afterwards. His allowing, however, that *similar appearances were sometimes found in the brain of persons subject to headachs,* was of more importance to the prisoner." Smith, p. 246.

The following is one among a thousand instances where death has been induced at *distant periods* from the infliction of violence on the head. The patient died several weeks after receiving the injury, and on dissection, Mr. Charles Bell discovered a fracture at the base of the skull; and the foramen magnum having been thereby roughened, a sudden turn of the head had forced a spiculum of bone into the spinal marrow. (Smith, p. 252.) The principal and important inference to be drawn from such cases is, "the *impropriety* of maintaining the general proposition, that the death of persons recovering from the *immediate* symptoms of violence, should never be ascribed to that violence." Mr. Howship relates a case, where a slight blow on the head, at the age of fifteen, produced death *forty years* afterwards. Pain was frequently present during life, and latterly somnolency and impaired vision. On dissection, the bone at the place injured was seen transparent, and almost wholly absorbed, and the portion of brain under it was indurated and schirrous. New-England Journal, vol. 9, p. 403.

* Foderè, vol. 3, p. 312. I must be permitted in this place to caution the young surgeon, not to use the trepan, without a due regard to the rules laid

Wounds of the face are more or less dangerous, according to the part injured, but in considering these, it is also necessary to take into account the deformity and irregular cicatrices that follow them. The latter circumstances have been noticed in the jurisprudence of England and our own country, as we shall state in the succeeding section.

Superficial wounds of the face are easily healed, but when deep, and attended with much loss of substance or denuding of the bones, they are tedious, and leave considerable deformity. Wounds of the forehead, in which the frontal muscles are divided transversely, or of the eyebrows, cause the upper eyelid to fall down, and may produce a lasting debility of the parts. Wounds of the eyes, when of considerable extent, must always be deemed dangerous, from the nature of that organ, and from the intimate connection between it and the brain. A wound with a sharp-pointed instrument, has been known to pass through the orbit, and prove fatal. Wounds of the transparent cornea always leave a scar, and intercept vision. Wounds of the iris cause a loss of sight, and if the instrument penetrates to the vitreous humour, the eye is left empty, thus combining blindness with deformity. Wounds of the nose, from a cutting instrument, leave great deformity, and particularly if the cartilaginous part be injured—if inflicted with a round instrument, or by a blow, it may not only be crushed, but the sense of smell may be destroyed. The ethmoid bone has been driven in this way upon the brain.* Lastly, a sharp-pointed instrument has sometimes penetrated the nose, touched the brain, and

down in surgical works. He may otherwise be injured in his reputation before a court of justice, and his practice may be condemned by those who are better informed. "There can be only one genuine reason for trepanning, viz. to remove such pressure from the surface of the brain as gives rise to *existing* bad symptoms." Cooper.

* "A man was killed by a blow on the nose—the consequence of which in the interim, was, that the lower jaw could not be opened, and in the opinion of the surgeon, he died from inanition, sixteen days after the accident. He was also unable to perform the usual natural evacuations. There was no fracture about the head, and the external wound had nearly healed up." Smith, p. 254.

hence proved fatal. Wounds of the external ear are unaccompanied with danger, but the deformity is a serious one. Wounds of the internal ear may either destroy hearing, or from their vicinity to the brain, prove in themselves dangerous. Wounds of the lips, if there be great loss of substance, not only deform, but are injurious to the speech, and are sometimes accompanied with a constant flow of saliva, particularly when any of the glands have been opened. Wounds of the ranular artery sometimes occur in children, from dividing the frœnum, and where the hæmorrhage cannot be suppressed, they have been known to prove fatal. Wounds of the parotid gland are always tedious in curing, and they sometimes become fistulous.

In all cases of wounds of the face, the physician should state in his report, the degree of deformity that has been produced.

Wounds of the neck also vary greatly as to their danger. Wounds of the integuments and muscles of the neck, may be considered simple wounds, but it must be added, that they generally heal with difficulty, in consequence of the mobility and looseness of the parts. Transverse cuts may indeed prove dangerous, and affect the motions of the head, or of the pharynx or larynx, and thus prove an impediment to the due exercise either of speech or deglutition. Wounds of the carotids and internal jugulars, are generally fatal, since it is often impossible to procure the necessary assistance in time to check the mortal hæmorrhage, and for this reason lacerated wounds of these parts are not so soon fatal as clean cuts. Wounds of the pharynx and œsophagus are peculiarly dangerous, as other important parts are generally divided along with them, but even if injured alone, as from stabs or gun-shot wounds, they are much to be dreaded, since the nourishment of the system must be carried on through them, and the action of deglutition is directly opposed to a speedy adhesion of parts. Even wounds of a portion of the

fibres surrounding the œsophagus, are dangerous, inasmuch as they induce a weakness of the action of deglutition, and also by the inflammation that sometimes supervenes, tend to induce compression on the trachea. Wounds of the larynx are serious injuries, as they derange or weaken the voice. A wound of the recurrent nerve alone on one side, seriously affects this organ, but if both be divided, a complete muteness will follow. Injuries of this description, however, if not of a complicated nature, cannot be considered mortal. Penetrating wounds of the trachea are always dangerous, since from its never being in a perfectly quiet state, it is difficult to produce a speedy reunion.* Numerous cases, however, prove that a partial transverse division is not mortal, but it is allowed that a complete division is generally so—more, however, from the vessels that must be divided to accomplish this, than from the injury itself.† Wounds of the par vagum, either on one or both sides, are absolutely fatal. Fractures of the cervical vertebræ are highly dangerous, and if the spinal marrow be injured, they are fatal.‡ Luxation of the neck is generally fatal, from pressure on the same part. Wounds piercing the vertebræ, or passing between them, are suddenly mortal. Injuries of the neck from contusion, are always dangerous, and should they end in death, must be judged of by the appearances that are found on dissection, as extravasated blood, laceration, &c.

Wounds of the thorax are divided into external

* A fatal case of rupture of the trachea by external violence, (a kick,) is mentioned in the Edinburgh Medical and Surgical Journal, vol. 18, p. 412.

† There are, however, cases mentioned by surgical writers, in which the trachea was completely cut asunder, and even the œsophagus opened, without any wound of the carotid artery. See Dorsey's Surgery, vol. 1, p. 69. A case is also given in the Edinburgh Med. and Surg. Journal, (vol. 16, p. 353,) in which the trachea and œsophagus were divided across, and which did not terminate fatally, although the parts did not reunite. This is a very interesting narrative.

‡ A remarkable case was stated by Soemmering in 1793, of a patient in whom there was a fracture and luxation of the vertebral column. He suffered extreme pain, and his extremities gradually became gangrenous—*but he survived five months.* Metzger, p. 320.

wounds—into penetrating wounds, unaccompanied with injury to any of the organs in that cavity, and into penetrating wounds, with lesions of those organs.

External wounds from a cutting instrument belong to the class of simple wounds, but from contusions or falls, may become dangerous, either through the extension of inflammation to the internal parts, or from the rupture of some blood vessels. Fracture of the ribs, if not complicated with their sharp points pricking inwardly, are not absolutely dangerous, although there is even then some impediment to respiration, and some apprehension of inflammation. But should the rib be much splintered, and the points not be reducible, it may end fatally. Penetrating wounds are not in general dangerous, unless combined with fracture of the ribs, or the rupture of some blood-vessels. Internal hæmorrhage or emphysema is often a dangerous, and even fatal symptom. Wounds of the lungs are dangerous, and the prognostic is always doubtful when the injury has been inflicted at the upper part of the thorax, or at the posterior side near the junction of the ribs with the vertebræ. The symptoms here require the strictest attention, as no case should be despaired of. These organs are also subject to concussion, which is termed *wind concussion*, and is usually fatal. Fractures, luxations, and contusions of the vertebral column, are all highly dangerous, and may sooner or later prove fatal.

It is difficult to conceive of the pericardium being wounded without a correspondent injury of the heart. But, if separate, it is to be deemed a highly dangerous wound. Wounds of the heart, of its ventricles and auricles, are mortal, but it is remarkable, that numerous cases are on record, where life has been prolonged for a considerable time after the infliction of the injury. Bohn quotes several cases of the kind,* and an instance occurred in the British army in Spain some years since, where a soldier survived for thir-

* Page 26, 221, 222.

teen days with a musket-ball in his heart.* The reason in some of these cases is, that the instrument which causes the wound, prevents, by its closing the aperture, that fatal hæmorrhage which otherwise would soon follow.† Wounds of the aorta and vena cava are fatal. It is hardly possible that the thoracic duct can be wounded without affecting other vital parts, but if it should occur, we must deem it fatal, as the chyle, instead of passing in its ordinary course, is diffused into the cavity of the thorax. For similar reasons, the lower part of the œsophagus is scarcely, if ever, wounded separately, but if so, it is certainly mortal, as it prevents the proper passage of the food, and totally impedes the function of nutrition. Wounds of the vena azygos are mortal, as they are attended with a hæmorrhage which it is impossible to suppress. Wounds of the diaphragm, if made with a sharp-pointed instrument, such as a sword, are dangerous, if only the muscular parts be injured; but if the tendinous ones are also injured, they are considered fatal.‡

As a general deduction from these remarks, it may be observed, that the prognostic in wounds of the thorax is, in most cases, an unfavourable one, although they are not often mortal, unless some primary organs be injured. John Bell indeed directs his pupils never to call any wound mortal, unless it be plainly

* Edinburgh Med. and Surg. Journal, vol. 14, p. 129. See also Triller *de mirando cordis vulnere post* xiv *diem demum lethale*, in Schlegel, vol. 5, p. 249.

† There are, however, some instances to which this explanation will not apply. I refer particularly to those cited by Dr. Dorsey, one from Dr. Babington, where a soldier lived some hours after a wound of the heart by a bayonet, and another from Pelletan, where the sufferer received a wound of the aorta from a small sword, and lived two months. "There is reason to believe," adds Dr. Dorsey, "that the heart has often been slightly wounded, without fatal consequences." (Surgery, vol. 1, p. 72–3–4.) See also Ballard, p. 331, 355. Belloc suggests that a clot may prevent the hæmorrhage, (p. 290.)

‡ I have taken this distinction from the systematic writers, although I am perfectly convinced of the correctness of a remark of Dr. Marc, that *it is useless to distinguish between wounds of its tendinous and muscular portions.* (Godman's West. Reporter, vol. 1, p. 44.) A very curious case of wounded diaphragm, which from its consequences, proved fatal at the end of eleven months, is mentioned in the Edin. Med. and Surg. Journal, vol. 8, p. 42.

a wound of the heart. This advice may be proper in surgery, but it can have no bearing on legal medicine, since it practically excludes all prognostics whatever. I have therefore given the best founded opinions that I could obtain, and will only add, that the prognostic in wounds of the lungs should in general be delayed, as the cases of recovery from desperate ones are so numerous, that we can never be justified in peremptorily declaring any particular instance a mortal wound. Wounds from fire-arms are, however, always more hazardous than those from cutting or sharp-pointed instruments.

Wounds of the abdomen, like those of the thorax, are divisible into external or penetrating wounds. The former are to be deemed simple, unless they have been accompanied with a violent shock of the system, or are of large extent. Penetrating wounds are to be dreaded, either from touching the peritoneum, and thereby causing inflammation, or from producing ventral hernia, and in the latter case, the apprehension will be graduated on the nature of the viscus that has passed out, and the inflammation and strangulation that accompany it.*

Penetrating wounds may also strike one or more of the viscera contained in the abdomen, and in that case, the accidents that occur, and the medico-legal questions that arise, are among the most perplexing of this branch of our subject. Wounds of the stomach are to be deemed highly dangerous, although there has been great diversity of opinion concerning their mortality. Bohn and Teichmeyer pronounce all mortal, and the instances of escape, as almost miraculous, while Alberti, Boerhaave and Valentini, consider those only mortal, which have injured the lower part and the two orifices. A wound of the stomach was declared accidentally mortal by the medical faculty of Giessen, and absolutely mortal by the medical col-

* The necessity of returning it as early as possible, is very manifest, and if this be not done, the criminal may escape punishment, at the expense of the surgeon's reputation. See a case of this kind in Smith, p. 263.

lege at Frankfort; while in an another case, a wound was considered mortal by the faculty at Leipsic, and not so by those of Helmstadt and Wirtemberg.*

This contrariety of opinion has arisen from a consideration of the following circumstances: wounds of the stomach have sometimes been cured without any bad consequences, various substances, such as knives, forks, pins, &c. have been swallowed without immediate injury; and the operation of gastrotomy has been occasionally performed with safety.† All these facts tend to show, that wounds of the stomach are not absolutely mortal, but they do not permit us to deny their danger. Certainly, if inflicted with a sharp pointed instrument, and penetrating, they are to be deemed hazardous, and the chance of death is increased when the blood vessels or nerves of the part have been injured. But a rupture or division of the coats of the stomach may also be affected by a severe contusion, or a blow on the part, without any external wound, surgically speaking, being present. Fabricius mentions the case of a man who was so dreadfully trod under foot, that not only the stomach was burst, but there was a rupture of the diaphragm, and the food passed into the cavity of the thorax, and notwithstanding this, except some slight elevations of the epidermis in the form of vesicles, the integuments and abdominal muscles did not appear in the least injured.‡ It will not appear surprising that sudden death should be the consequence of a blow on the epigastric region, when it is recollected that it is the seat of the solar plexus, and of the semi-lunar ganglion, parts especially subservient to life, and also that on dissection, no inflammation of the stomach and the other organs, should in such a case be found.§ Wounds of the

* Mahon, vol. 2, p. 122. Valentini's Pandects, vol. 2, p. 413 to 432. All the writers on legal medicine agree, that a wound inflicted on a full stomach is more dangerous than one, on that organ when empty. It should therefore be a subject of enquiry, how long before the injury a meal had been taken.

† See a case of this nature in the Medico-Chirurgical Review, No. 1, p. 103. Also in Philosophical Transactions, vol. 19, p. 178.

‡ Mahon, vol. 2, p. 126.

§ "Inspectio et sectio aliquando nihil declarant," says Bohn, p. 114. So

intestines are less to be dreaded than those of the stomach, and the instances of recovery are infinitely more numerous. But although all surgical works abound with these, we must not deem them destitute of danger, and if death follows after proper treatment, it is to be attributed to the injury. Wounds of the smaller intestines are more dangerous than those of the larger, not only because they perform more important functions, but are supplied with a greater number of nerves. Wounds of the mesentery cannot be deemed mortal, unless some of the large blood vessels of the organ, or its principal glands, be injured, and in these cases, the danger arises from not being able to suppress the hæmorrhage, or to supply the loss of the chyle. Wounds of the omentum are to be estimated like those of the mesentery ; but it deserves remark, that a contusion is apt to induce inflammation and gangrene. Wounds of the pancreas seldom occur, unless some other viscus be injured at the same time. If they should happen separately, the cause must have been an instrument entering at the back, and its wound cannot be considered as mortal, unless some arterial or venous vessels have been injured. Wounds of the liver are generally mortal, and their fatality originates in some blood vessel being injured, or in the consequences that ensue. Superficial injuries are, however, frequently healed. Wounds of the gall-bladder are deemed absolutely mortal, as its fluid is stimulating to a high degree, and occasions inflammation and most violent pain.* Wounds of the

also sometimes with blows on the head ; and a case of the latter description is cited by Smith, (p. 250,) from the History of the Royal Academy of Sciences of Paris. " A stout young criminal, condemned to be broken on the wheel, ran head foremost against the wall of his dungeon, with his hands behind him, and instantly fell dead. On opening the head, not the slightest appearance of injury was discoverable either in the skull, brain, cerebellum, or spinal marrow, except a very minute separation in the squamous suture, which could not account for so sudden a death. The substance of the brain was unusually firm."

* There are but very few cases on record of wounds of the gall-bladder, distinct from other injury. One is mentioned in the Phil. Transactions, vol. 36, p. 341, of an officer, where the fundus was penetrated. He lived a week. Sabatier mentions another case. Cooper's Surgical Dictionary. See also Metzger, p. 366.

various ducts are mortal. Those of the spleen are to be estimated like wounds of the liver; if deep and penetrating, death will follow from hæmorrhage. There are, however, many cases of recovery from injury to this organ.* It is a common circumstance in cases of sudden death from accidents, falls, &c. to find the spleen or liver lacerated, and this is therefore to be deemed a fatal injury. Wounds of the kidneys have often been successfully treated; they are, however dangerous, according to their depth, and the effusion of urine (if any) into the abdomen. So also with wounds of the ureters. Wounds of the bladder would not seem to be even very dangerous, if we look at the success which ordinarily attends the operation of lithotomy. They may, however, prove hazardous from the effusion of its contents, or the injury of a blood vessel. Wounds of the neck and sphincters of the bladder, are apt to leave incontinence of urine, and when this does occur, it should be stated in the report. Wounds of the uterus are dangerous in proportion to the hæmorrhage that follows, and the symptoms that supervene. If that organ be impregnated, the danger is of course increased.

In all these instances of wounds of the abdomen, the danger is aggravated from extravasation, and this again is increased according to the nature of the fluid, which may be either blood, chyle, bile, fœcal matter, or urine. An extravasation of blood is often within the power of the surgeon, but its consequences are however always to be dreaded. The other evacuations can scarcely, if ever, except in the case of the urine, be remedied by means of operations, and are hence very generally mortal.†

Wounds of the testicles are dangerous, particularly if they have been contused or injured by a sharp

* A case is related by Mr. Ferguson, surgeon, where a part of the spleen was removed with safety. Phil. Transactions, vol. 40, p. 425.

† "The complete effusions of bile, urine, and fœculent matter, prove uniformly fatal, by their quality inducing a destructive inflammation." Travers on Injuries of the Intestines, London ed. p. 72.

pointed instrument. Their division indeed by a cutting instrument may be mortal, unless the subsequent hæmorrhage be speedily prevented. The same remark applies to wounds of the penis, but in other respects, injuries of this organ are not to be deemed dangerous.

The extent and variety of injuries that the abdomen and the viscera contained in it may receive, call for all the skill of the surgeon, and his judgment will be frequently exercised in deciding on the fatality or danger of wounds of this part of the system.

Wounds of the extremities are to be decided upon according to their nature, but the majority of them are not dangerous. Of simple wounds, I have already spoken, and it is sufficient to add, that when the integuments and first layer of muscular fibres only are wounded, they will heal without difficulty. The presence of syphilis and scrophula may however cause their degenerating into ulcers, and it must also be noticed, that wounds of the extremities, in which the muscular fibres are transversely divided, will take a long time to heal. Contusion also, may increase the inflammation, or induce suppuration. Wounds of tendons are generally tedious, and when cured, are often followed by a loss of substance, and a want of mobility in the parts. Compound fractures are sometimes hazardous—as also fractures near articulations, or of parts surrounded by large masses of muscles. Comminuted fractures are extremely tedious in their cure. Finally, fractures in young persons, and in those who are in good health, are more readily healed than in old persons, valetudinarians and pregnant women. Wounds complicated with dislocations sometimes induce alarming symptoms, as also those in which an important nerve is divided. The prognosis however is favorable, unless serious symptoms supervene on the disease and which are referable to it. Wounds of the arteries and veins are not at the present day considered dangerous by modern surgeons, if timely aid be afforded, but under other cir-

cumstances, a wound of a large artery may prove fatal. The system may be injured, or so much blood may have been lost, as to render assistance of little value.* It is extremely rare, that wounds of the veins prove dangerous, except the brachial or femoral ones be wounded near the trunk. Wounds of the articulations are generally to be dreaded, and the apprehension is increased when they are complicated, as for example, with contusion, hæmorrhage or fracture.

Finally, the prognostic from wounds from fire-arms is, in all cases, more serious than that of wounds from cutting instruments.†

Such are, in a short a space as possible, the various prognostics of the numerous wounds (in a medico-legal sense) to which the body is liable. But I must again remark in this place, that these or similar rules are not to be taken as infallible guides. It is only to aid the examiner in pronouncing an opinion, that they deserve any attention, and he should rely principally on the circumstances of the case that is immediately before him. "It has indeed been argued, that it is not enough to say, that the person died of the wound, but that the wound must be characterised as mortal, thus taking advantage of the systematic arrangement in books on surgery, and deducing the conclusion, that when a man dies of a wound that is not there arranged as mortal, it must have originated from bad treatment, or misconduct, or irregularity on the part of the patient.‡ But the insufficiency of these divis-

* The following case may also occur. "J. Denton was indicted in September, 1813, at the Old Bailey, for the murder of C. Denton. He had struck her with a knife, and she lived a month thereafter. The medical testimony stated, that the wound had nearly divided the arteries of the arm—*it mortified, and she died in consequence.* He was condemned and executed." Edinburgh Annual Register, vol. 6, part 2, p. 121.

† The authorities on which this section is founded, are Bohn, Foderè, and Mahon. The two last are in many respects a copy of the former. I have also consulted Samuel Cooper's Surgical Works, Dorsey's Surgery, and Charles Bell's Operative Surgery, together with Metzger and Belloc, and the various dissertations in Schlegel.

‡ Lawyers are very apt to push the question as to the mortality of wounds to a considerable length, and by this means endeavour to embarrass the medical witnesses. I recommend the answer of the surgeon who deposed

ions has been often proved. Thus "in a case of one John Shaw at the Scotch bar, three physicians and two surgeons swore, that by the rules of their prognostics, the wounds received by James Houston were mortal, whereas Houston was alive, and the plaintiff in the very cause, in which these gentlemen gave this testimony."*

When a surgeon is called on to examine a wound, the effects of which may become the subject of a criminal trial,† he should ascertain, 1st, whether it has been already dressed, or if some surgeon has not been attending to it; and 2d, whether the situation of the wounded person allows of an examination. Both these are important, as much may depend on the skill and care with which the first dressing has been made; and again, should an examination take place while the patient is in a feeble state, and death follow during it, popular opinion will certainly attach great blame to the surgeon. The juridical examination of a wounded person must also be deferred in some cases, where the point or part of an instrument remains in the wound. Here a consultation is fre-

on the trial of Count Koningsmark for the murder of Mr. Thynne, to the notice of the latter. Mr. Thynne was shot with a blunderbuss, and Mr. Hobbs, the surgeon, swore that he had examined the body after death—that four bullets had entered it—"that they tore his guts, and wounded his liver, stomach, and his gall—wounded his great guts and his small guts, broke one of his ribs, and wounded the great bone below."

Sir Francis Withens. Did he die of those wounds?

Mr. Hobbs. Yes, he did die of those wounds.

Mr. Williams. Did you apprehend them all mortal, or any, or which of them?

Mr. Hobbs. I believe there never was a wound, but it might prove mortal. —Hargrave's State Trials, vol. 3, p. 473.

* Edinburgh Med. and Surg. Journal, vol. 1, p. 339.

† I mention the following case, as it may be important for the surgeon to be aware of the doctrine contained in it. In the case of The King v. Salisbury, the prisoner was committed to Newgate for stabbing a gentleman with a knife, so that his life was despaired of. She moved that a physician and surgeon of her own nominating, might be permitted to be present at the dressing of his wound, so as to be able to satisfy the court that he was out of danger, in order that they might bail her. *Sed per curiam.* There never was a motion of this nature, especially so early as this. The course is for the friends of the party injured to lay his condition before the court, when they oppose the bailing; if they do not do it, we may order such an attendance for our own satisfaction, but at present the defendant has no right to demand it. 1st Strange's Reports, p. 547.

quently required to determine on the propriety of its removal, and the question has often arisen, whether the death of the patient will not be hastened by immediately withdrawing it.

Let us, however, suppose the wounded person to be in a fit situation for the surgical and juridical examination. It is then necessary, before proceeding to it, to ascertain the nature and shape of the instrument by which the injury was inflicted. Enquiry should also be made as to the relative situation of the parties, at the moment of the wound—their respective stature, and position.* The examiner cannot be too minute, and he should be cautious in not making any observations on the nature of the wound, before he has fully satisfied his own mind, lest they may hereafter be used to the disadvantage of his evidence. The form, length, breadth, depth, and direction of the injury, together with all the other circumstances already mentioned, should be noticed, and a detailed summary of the whole should then be drawn up in the form of a report. I must, however, caution concerning the impropriety, and indeed inutility of declaring any wound, concerning which there can be the least doubt, absolutely mortal. All that can be required by judicial officers, is a declaration, that in the opinion of the examiner, the life of the wounded person is in danger from the injury he has received; and on this, they are sufficiently enabled to take all the precautionary steps that may be necessary. During the illness, it will be proper to keep a journal, and if the

* It has at various times been a subject of anxious discussion, whether there are any proofs to be drawn from the nature of the wound, discriminative of the injured individual falling on the weapon, or of its having been thrust into him. This question was put to the Medical Faculty of Giessen in 1685, in the case of a wound of the breast, and they decided from *accompanying* circumstances, that the former was probable. Valentini's Pandects, vol. 1, p. 240. In a late trial in England, of an officer of the guards for the murder of a private, two surgeons deposed, that from the nature of the wound, they would take it upon themselves to declare, that it must have been inflicted by the body falling upon the sword, and not occasioned by a thrust of the weapon. London Med. and Phys. Journal, vol. 31, p. 467. The grounds on which they formed this opinion, are not stated.

event prove fatal, we have a safe guide to resort to, in dissection. The wounded parts must be minutely examined, and from them, a just conclusion can be drawn whether the injury was the cause of death.*

It is not necessary in this place to state the distinctions that exist in our law, and that of England, respecting the crime of killing, since they relate to the intent, and can have but a slight bearing on the nature of wounds. There is one English statute, however, which deserves mention. It was passed in the reign of James I. and declares, "that the thrusting or stabbing another, who has not a weapon drawn, or who hath not then first stricken the party stabbing, *so that he die thereof within six months after*," shall be adjudged murder, though done upon sudden provocation.† In the state of New-York, the same statute has been enacted, and it contains the same provision as to time, *(six months.)* It is to be deemed murder, "although it cannot be proved that the same was done of malice aforethought."‡

This provision as to a specific period of time, during which death must follow in order to constitute the crime of murder, appears to have entered into the laws of various countries. Thus among the Lombards, the criminal was held guilty, if the individual injured died within a year.§ In Prussia, on the contrary, the *practice* is, that the death must take place within nine days, although the *penal code* of that country contains no directions respecting this subject.‖ In France it is fixed at forty days,¶ while in England, the individual was held amenable for the consequences during a year and a day.** All these restrictions are evidently improper, since death may follow at a longer or shorter period of time, and be strictly and indisputably traced to the wound in question. It is a much safer mode to look at the intent, and proportion the punishment accordingly.

* Foderè, vol. 3, p. 402 to 432.
† Blackstone, vol. 4, p. 193.
‡ Revised Laws, vol. 1, p. 67.
§ Bohn, p. 101.
‖ Metzger, p. 325.
¶ Ballard, p. 325.
** Blackstone, vol. 4, p. 197.

3. *Of Mutilation.*

It will readily occur to the reader that there may be many wounds, which though not mortal in their nature, are still incurable, and these may either leave permanent deformity, or incapacitate or weaken one or more of the functions of the body. Laws directed to the punishment of such injuries, have accordingly been enacted in various countries, and as some are in force in this state, the propriety of a brief notice is evident.

I will commence by mentioning those in force in France, as there is a uniformity between the English law and our own.

The code of 1791, established a scale, founded on the proportionate magnitude of the injury. Whenever an individual was so wounded as to be unable to apply himself to any manual labour for the space of forty days, the criminal was directed to suffer two years imprisonment. Three years were appointed in case the arm, leg, or thigh was broken; and four years, when there was an absolute loss of sight in one eye, a complete loss of the use of a member, or a mutilation of some part of the head or body. It was extended to six years, provided there was an absolute blindness, or a total inability to use either both arms or both legs.*

The code now in force does not contain these distinctions, but leaves to the judges the power of varying the period of imprisonment. It is, however, in one respect, more severe than the former, as it prescribes imprisonment generally against the individual who shall, either by wounds or blows, injure a person so that he is ill, or unable to labour, for the space of twenty days thereafter. And this imprisonment is to be not less than five, nor more than ten years.† One species of mutilation is, however, particularly noticed, viz. castration. It subjects the criminal to

* Foderè, vol. 3, p. 427. † Ibid. p. 428.

hard labour for life, and if it should prove fatal within four days, he is to suffer death. Outrages against decency are alone to excuse from this punishment.*

In the English law, the term *Mayhem* is applied to the cases now under notice. This is defined by Blackstone, to be "the violently depriving another of the use of such of his members, as may render him the less able in fighting either to defend himself or annoy his adversary. And therefore, the cutting off, or disabling, or weakening a man's hand or finger, or striking out his eye or fore-tooth, or depriving him of those parts, the loss of which in animals abates their courage, are held to be mayhems. But the cutting off his ear or nose, or the like, are not held to be mayhems at common law, because they do not weaken, but only disfigure him."

"By the common law also, mayhem has for a long time been only punishable with fine and imprisonment, unless perhaps the offence of mayhem by castration, which all our old writers held to be felony; and this, although the mayhem was committed upon the highest provocation."†

Subsequent statutes have, however, more clearly defined the crime and its punishment. By a statute passed in the 5th year of Henry IV. it was enacted, that the beating, wounding, or robbing a man, and then cutting out his *tongue*, or putting out his *eyes*, shall be considered a felony. Next, was the statute 37 Henry VIII. which directs, that if a man shall maliciously and unlawfully cut off the *ear* of any his majesty's subjects, he shall not only forfeit treble damages in a civil suit, but ten pounds by way of fine to the king, which was his criminal amercement.

* Foderè, vol. 3, p. 244.

† The ancient Anglo-Saxon laws contained a regular scale of fines for personal injuries of this description. The loss of a leg or eye subjected the offender to a fine of fifty shillings; a wound that caused lameness, thirty shillings; one that caused deafness, twenty-five shillings; piercing the nose was punished with a fine of nine shillings; a front tooth was compensated for by six shillings, and an eye tooth by four shillings. Money, it must be remembered, was in those days one hundred times more valuable than at present. Edin. Encyclop. vol. 2, p. 94, Amer. ed.

After this, was passed the Coventry act, in the reign of Charles II. and so called from its being occasioned by an assault on Sir John Coventry in the street, and slitting his nose, in revenge (as was supposed) for some obnoxious words uttered by him in parliament. This ordains, that if any man shall, of malice aforethought, and by lying in wait, unlawfully cut out or disable the *tongue*, put out an *eye*, slit the *nose*, cut off a *nose* or *lip*, or cut off or disable any *limb* or *member* of any other person, with *an intent to maim or to disfigure* him, he shall be deemed a felon without benefit of clergy.*

The law in the state of *New-York*, is taken from several of the above. As it is short, I will quote it at length. It enacts "that if any person shall on purpose and of malice aforethought, cut out the tongue, or put out the eyes of any other person, or if any person shall on purpose and of malice aforethought, and by lying in wait, unlawfully cut out or disable the tongue, put out an eye, slit the nose or lip, or cut off or disable any limb or member of any other person, with intent in so doing to murder or kill, or to maim or disfigure, in any of the manners aforesaid, every such offence shall be deemed and adjudged felony."† And by another law, the punishment for the crime is directed to be imprisonment in the state prison for life.

Some interesting decisions have been made in England under the Coventry act, and as they are applicable to our own, should similar cases occur, I will mention a few.

In 1721, Mr. Coke, a gentleman of the bar, and one Woodburne were indicted, the one for hiring and abetting, the other, for actually slitting the nose of Mr. Crispe, the brother-in-law of Coke. On the trial, Mr. Sturgeon, the surgeon, swore that there

* Blackstone, vol. 4, p. 205, 206, 207.

† Revised Laws, vol. 1, p. 168. A law similar to the above in many respects, was passed in England in the 43d of George 3d. All wilful or malicious stabbing or cutting, with intent to murder, rob, *maim*, *disfigure*, or *disable*, *or to do some grievous bodily harm*, is declared felony

were several wounds on the face, one wound divided the right side of the nostril, and made an oblique cross over the wound, and ended near the right under-jaw. The nose was cut from without into the nostril, the edge of the nose was not cut through, but there was a cut or slit in it, that went through. Mr. Coke, with great effrontery, said, that his aim was to murder, and not to maim or disfigure. When the verdict of guilty came in, he asked whether the nose could be said to be slit, within the meaning of the statute, when the edge of it was not cut through. To this, the lord chief justice (Sir Peter King) replied—"It is true, the edge of the nose was not slit, but the cut was athwart the nose, which cut separated the flesh of the nose, and cut it quite through the nostril. This I take (he added) to be a slitting of the nose, and *the surgeon swore the nose was slit.*" Both Coke and Woodburne were executed.*

In the case of one Carrol, at the Old Bailey sessions, in July 1765, it appeared that he had struck the prosecutor, (Mr. Kirby,) with a razor bladed knife across the nose and eyes—and upon examination, it appeared that the two great blood vessels in the forehead were divided—that there was a large transverse wound across the nose, so wide open, that the bone was visible. It began from the right, and went across the eyelids and across the nose. The muscles of the nose were cut through, and it proceeded to the left eyelid, and terminated at the temple. A nerve was also cut. It was stated in evidence, that in many old writers on surgery, such wounds are called slits, but that slit is not a word made use of now. The word *slit* is understood as synonimous to the word *cut*, but the idea which was formerly conveyed by the word *slit* is now expressed in speaking technically, by the word *divided*. The jury found the prisoner guilty, but it was questioned, whether a transverse cut was a slitting, within the meaning of

* Hargrave, vol. 6, p. 211.

the act, *the wound not having perforated the nostril.* It was accordingly referred to the judges, who held that the offence was properly proved, and the prisoner was accordingly executed *

Lastly, one Tickner was tried in 1778, at the Old Bailey, under the same act, for injury done to William Jacob. There were several wounds on various parts of the body, but the cut on the nose had divided the integuments in an oblique direction. It went down to the bone, but not through the bones of the nostrils, nor did it penetrate to the nostrils, and was rather a scratch, than a slit. It was however sufficient to leave a mark visible for some time. The prisoner was convicted, but sergeant Glynn ordered the execution to be respited, until the opinion of the twelve judges could be procured, whether this conviction was proper within the meaning of the Coventry act. They were of opinion, that the conviction was right.†

In *Connecticut*, it is enacted, that "every person who shall of malice aforethought, and by lying in wait, cut out or disable the tongue of another, or put out the eye or eyes of another, so that the person is thereby made blind, or cut off all or any of the privy members of another, and shall be thereof duly convicted, shall suffer death.

"Every person who shall of malice aforethought, put out an eye, slit the nose, cut or bite off the nose, ear or lip; or cut, or bite off or disable any limb or member of another person, with an intention in so doing to maim or disfigure such person, and shall be thereof duly convicted, shall suffer imprisonment for life, or such term of years as the court may direct.†"

In *New-Jersey*, *New-Hampshire*, *Massachusetts*,

* East's Treatise, p. 399. Lawyer's Magazine, vol. 1, p. 202.

† Lawyer's Magazine, vol. 1, p. 203. William Lee was tried at the Old Bailey in 1763, for attempting to *cut his wife's throat* with a razor while asleep. The wound was three inches in length, and quite across, but did not prove mortal. This was held not to be an offence within the Coventry act.

‡ Revised Laws, 1821, p. 151, 152.

Rhode-Island and *Pennsylvania*, the laws are similar to the one in New-York, and the punishments are fine or imprisonment, or both.*

In *Vermont*, the only crimes of this description specified, are cutting out the tongue, putting out the eyes, or cutting off the privy parts, and the punishment may be imprisonment for life, or a large fine.†

In *Delaware*, the crimes included in the Coventry act, were by a colonial law, made punishable by death, and I cannot find that this has been repealed.‡

* Revised Laws, New-Jersey, 1821, p. 259. Laws of New-Hampshire, 1797, p. 279. Laws of Massachusetts, 1807, vol. 3, p. 283. Laws of Rhode-Island, 1798, p. 589. Laws of Pennsylvania, 1803, vol. 5, p. 3. With reference to Massachusetts, see also the case of the Commonwealth v. Newell and others. Massachusetts Reports, vol. 7, p. 245.

† Laws of Vermont, 1808, vol. 1, p. 334.

‡ Laws of Delaware, 1797, p. 69.

CHAPTER III.

POISONS.

Definition of a poison—Remarkable resistance sometimes observed to the action of poisons—in individuals—in animals. Modes in which poisons may be introduced into the system. Division of poisons—division proposed by Foderè, and adopted with modifications by Orfila. 1. Signs of poison on the living body. Symptoms of the corrosive or acrid poisons—the narcotic—narcotico-acrid—astringent—Causes that may modify or vary the progress of symptoms. Preliminary directions for the analysis of suspected substances—Insufficiency of chemical analysis, in poisoning by vegetable substances—Exhibition of the suspected substance to animals. Directions of Orfila on this point. Of poisoning during illness. Of slow poisons—of poisons administered to several persons at the same time—variety in their effects. Of poisoning as the result of suicide or homicide. Diseases and symptoms that may be mistaken for the effects of poison—idiosyncracy—indigestion—sudden illness. 2. Signs of poison on the dead body. Rules for dissection. Appearances on dissection from the corrosive poisons—the narcotic—the narcotico-acrid—and the astringent—Variety in these. How far the presence of putrefaction affects the value of dissections. Of the introduction of poisons into the body after death—Appearances indicative of this. Slow poisons. Appearances observed on dissection in certain diseases, which may be mistaken for poison—in cholera morbus—repelled eruptions. Phenomena that may be mistaken—the vascularity of the stomach—digestion and perforation of the stomach—Rupture of the stomach.

"The means of ascertaining the traces of poisons, either on the living or the dead body, is one of the most important subjects in legal medicine, and its importance is only equalled by its difficulty."

I propose to consider the subject under three general divisions.

1. The signs of poison in the living body.
2. The signs of poison on the dead body.
3. The various kinds of substances that may, or have produced these dangerous and fatal effects.

Previous to an examination of these, a few preliminary observations will be proper.

What is a poison? The ancients considered every

thing as poisonous, that produced malignant symptoms, and attacked directly what we style the vital principle. Thus, miasma was with them a poison, and their remedies, or antidotes, were accordingly directed to the support and cherishing of the vital heat, and to increase action throughout the body. Hence also the name of alexipharmics, and the belief of driving out poison by transpiration. The common idea of a poison by the moderns, on the other hand, is that it is a substance which, on being applied in one or other way to the human body, is capable of destroying the action of the vital functions, or of placing the solids and fluids in a situation that prevents the continuance of life. Dr. Mead's definition includes every substance which, in small doses, can produce great changes on the living body. This is evidently too extensive, since it embraces many articles that are not regarded as poisons, and excludes others that are really so. Thus, a small quantity of bread or water has produced great changes, whilst opium or corrosive sublimate has been taken in large quantities, without injurious effects. The definition given by Foderè, although liable to criticism, is probably as unexceptionable as any that has yet been offered. He considers poisons to be those substances which are known by physicians as capable of altering or destroying, in a majority of cases, some or all of the functions necessary to life.* The great and leading object in medico-legal cases, necessary to complete the idea of a poison, is the intent with which the substance is given.

Another interesting question, is the manner in which poisons act. This has been a subject of fruitful discussion among modern physiologists, and our own country has not been wanting in ardent examiners respecting it.† It is not necessary, with reference

* Foderè, vol. 3, p. 449.

† See Ducachet's Inaug. Dissertation on the action of poisons. Somerville's Inaug. Dissertation on the organs of aborption. (Chapman's Journal, vol. 2, p. 408.) Report of the committee of the academy of medicine, on the means by which aborption is effected. Ibid. vol. 3, p. 282. Dr. Milnor's

to the science of medical jurisprudence, to enlarge on the varied results obtained by experimentalists, nor to enter into a discussion concerning the weight of testimony in favour of the blood-vessels, the nerves, or the lymphatics, as the medium by which poisons produce their effects. A concise notice of the consequences observed from each individual poison, will be more appropriate to the object of the work, and this will accordingly find its proper place in the third division of the subject.

The remarkable resistance that is sometimes observed to the action of poisons, also deserves an early allusion. Instances of this nature are so numerous, that a selection of the more striking will be sufficient to illustrate the position.

Among the Hungarians, the seeds of the *Palma Christi* are often taken, to the amount of thirty-six grains, without any inconvenience, and some of the French peasantry use a decoction of *colocynth* as a common purgative. The common dose of the extract of the *aconitum napellus* is one or two grains, and it is deemed dangerous to use it in larger quantities; but Foderè was consulted concerning the case of Charles IV. of Spain, who, while residing at Marseilles, was attacked with a rheumatic gout, and he recommended the medicine in question. M. Soria, the king's physician, replied, that at a former period, it had been administered for a length of time, and to such an extent, that the patient took a drachm daily, without any good or evil effects. This monarch was now sixty-two years of age, athletic, and had an excellent appetite.* The fumes of mercury, of lead, and of copper, are well known to be injurious to those who inhale them, yet no fact is better established than that of workmen resisting their effects for many years. "In the mines of Peru," says Humboldt,

Experiments. Ibid. vol. 4, p. 10. Dr. Hubbard's Experiments. Ibid. vol. 4, p. 242. Drs. Lawrence and Coates' Experiments. Ibid. vol. 5, p. 327. Also Dr. Hale's Boylston Prize Dissertation.

* Foderè, vol. 3, p. 468.

" from five to six thousand persons are employed in the amalgamation of the minerals, or the preparatory labour. A great number of these individuals pass their lives in walking barefooted over heaps of brayed metal, moistened and mixed with muriate of soda, sulphate of iron, and oxide of mercury, by the contact of the atmosphere and the solar rays. *It is a remarkable phænomenon,*" he adds, " *to see these men enjoy the most perfect health.*"* Again, in all the Savoyard and Swiss Alps, milk is collected and kept in small copper vessels, and in Germany, preserved fruits are put into vessels of this metal, in order to give them a green colour, and all without inducing any injury.† The most astonishing of cases, however, on record, is that of the old man at Constantinople, who had been in the habit for thirty years, of swallowing enormous quantities of corrosive sublimate, until his dose came at last to be a drachm daily. He was living in 1800.‡

These exceptions to general rules are best explained on the principle of idiosyncrasy, or of habit rendering the system innoxious to their effects.‖ And such extraordinary instances should, above all, never influence us in legal medicine, nor lead us to the idea, that because one person has taken a particular substance without any ill effects, it is therefore not a poison. The academy of Berlin was consulted in 1752, whether copper was a poison. They replied, that they did not consider it decidedly so, since several had taken it with impunity, either separately or mixed with food. Now, if this decision receives a ge-

* Francis' Inaugural Dissertation on Mercury, p. 27.

† Foderè, vol 3, p. 449.

‡ This case was first mentioned by Dr. Pouqueville. Mr. Thornton doubted the story, and criticised the name given him. Lord Byron, in the notes to his Childe Harold, attacked Mr. Thornton in his turn. And thus " this man, (says Mr. Hobhouse) though nearly one hundred years old, was, like Partridge the almanack maker, almost reasoned out of existence by a verbal criticism, which has turned out to be incorrect." Hobhouse's Albania, vol. 2, p. 945. Lond. ed.

‖ The quantity of opium taken daily by many of the Turks, is also a striking proof of this.

neral application, we may undoubtedly adduce examples of wonderful escapes from the effects of almost all noxious substances, and thus destroy the idea of poison altogether.*

There is another curious fact connected with this subject, which it is proper to mention. It is, the different effects which some substances produce on man and other animals—being noxious to the one, and innoxious to the other, and vice versa. Thus, sweet almonds kill dogs, foxes and fowls—aloes is destructive to dogs and foxes, pepper to hogs, and parsley to the parrot. On the contrary, the leopard's bane (arnica montana) is fatal to man, while it is food for wild goats and swallows. Hogs feed on henbane, (hyoscyamus)—pheasants on stramonium, and sheep on hemlock and the manchineal apple with impunity. Even arsenic is said to prove harmless to the wolf.†

The danger of poisons, as well as the rapidity of their action, varies considerably. Animal poisons are probably the most speedily and the most certainly fatal, though they would seem to be equalled in both respects, by some of the vegetable poisons when introduced by puncture into the system. I refer particularly to the poisoned arms of savage nations. Next, the mineral, and the lastly the vegetable poisons. The latter, though generally slower in their operation, are often no less destructive.

Poisons may be introduced into the system in various ways : through the nose, in the form of odours—through the lungs, by inspiration—by the mouth and œsophagus, in the form of food—by the anus, in the form of injection, and through the skin by absorption.‡

* Foderè, vol. 3, p. 470.

† Foderè, vol. 4, p. 203. Mahon, vol. 2, p. 302. Ducachet, p. 20. Beckmann, (vol. 1, p. 52) says, that four drachms of sugar given to a pigeon, killed it in four hours, and five drachms, a duck in seven hours.

‡ Foderè, vol. 3, p. 481. There are many curious accounts on record of the mode, in which poison was supposed to have been perpetrated. Thus Zacchias says, that Pope Clement VII. was poisoned by the smoke of a candle, and it has been supposed that dresses and jewels might be impregnated with venomous matter. Queen Elizabeth was to have been poisoned by

In noticing individual poisons, two modes of arrangement have been pursued by various writers; the one founded on the basis of natural history, and the other upon the action of these substances on the living system. The latter has of late years been most generally adopted by authors on toxicology, with however great variety as to their classification. There are however some objections to following it implicitly in a work on medical jurisprudence, since, in addition to its allowed incompleteness, it is arranged principally on a view of symptoms.* These, though highly important, are but a part of the objects of investigation in the science under consideration.

It is notwithstanding practicable, I apprehend, to combine both in such a manner as to increase their respective utility. Nearly all the corrosive poisons, for example, of Foderè and Orfila, belong to the mineral kingdom and the septic to the animal, while the acrid, narcotic, and narcotico-acrid, divide the vegetable kingdom. I propose therefore, to follow the natural history method generally, and when we arrive at vegetable poisons, consider them under the above division, taking care at the same time, to mention any individual substance in the other kingdoms which differs in action from its associates.

The division of poisons, proposed by Foderè, and adopted and modified after him by Orfila, may be introduced in this place. It contains six classes, viz.

spreading some on the pommel of the saddle. "The queen, in mounting, would transfer the ointment to her hand; with her hand, she was likely to touch her mouth or nostrils, and such was the virulence of the poison, that certain death must follow." Aikin's Memoirs of Queen Elizabeth, Amer. ed. vol. 2, p. 306. There is a minute of council extant, in the hand-writing of Cecil, which contains, among other things, the following caution: "That no manner of perfume, either in apparel, or sleeves, gloves, or such like, or otherwise that shall be appointed for your majesty's savor, be presented by any stranger, or other person, but that the same be corrected by some other fume." Ibid. vol. 1, p. 299.

* "The arrangement of M. Foderè is rather calculated for a *natural history of poisons*, than to elucidate this branch of juridical medicine." Edin. Med. Jour. vol. 1, p. 339. See also Smith, p. 66.

The Corrosive or escharotic,
Astringent,
Acrid,
Narcotic or stupifying,
Narcotico-acrid,
Septic and putrefying.*

The substances belonging to each, are as follows :

CLASS I.

Corrosive or Escharotic Poisons.

Arsenical Preparations.
- Arsenious acid, or white oxyd of arsenic
- The arsenites
- Black oxide of arsenic, fly powder
- Arsenic acid
- Arseniates of potash, soda, and ammonia
- Yellow and red sulphurets of arsenic

Mercurial Preparations.
- Corrosive sublimate
- Nitrate of mercury
- Red precipitate
- Red oxyd of mercury, (precipitate *per se*)
- Sulphate of mercury, (turbith mineral)
- White precipitate
- Mercurial vapours

Antimonial Preparations.
- Oxide of antimony
- Tartar emetic
- Antimonial wine
- Muriate of antimony
- Kermes mineral, beyond medical doses
- Golden sulphur of antimony, do.
- Cinnabar of antimony, &c.
- Antimonial vapours

Copper.
- Oxide of copper
- Sulphate of copper
- Nitrate of copper
- Muriate of copper
- Acetate of copper
- Ammoniacal copper
- Coppery soaps
- Coppery wine

Silver.
- Nitrate of silver

Gold.
- Muriate of gold
- Fulminating gold

Zinc.
- Oxide of zinc
- Sulphate of zinc

Bismuth.
- Nitrate of bismuth
- Sub-nitrate of bismuth

Tin.
- Muriate of tin
- Oxides of tin

Acids, concentrated, and in particular,
- Sulphuric acid
- Nitric acid
- Muriatic acid
- Phosphoric acid
- Fluid nitrous acid
- Sulphureous acid
- Fluoric acid
- Phosphorous acid
- Oxalic acid
- Tartaric acid

Alkalies, caustic.
- Potash
- Soda
- Ammonia

Alkaline carbonates in large doses

Caustic alkaline earths.
- Barytes, and its salts
- Quicklime

Phosphorus

Glass and enamel in powder

* In his manual, entitled "*Directions for the treatment of persons who have taken poison*, &c." Orfila has somewhat modified this division. The arrangement there is as follows: *Irritating*, or those which produce inflammation of the parts to which they are applied. And under this, he includes the preparations of lead, thus virtually abolishing the class of astringent poisons, except so far as relates to saturnine emanations. He also includes under this, the acrid vegetable poisons. This, indeed, he virtually did in his toxicology. 2. *Narcotic.* 3. *Acrid narcotic.* 4. *Septic.*

Cantharides
Iodine
Hydrogenated sulphuret of potash

CLASS II.

Astringent Poisons.

Lead.
Acetate of lead
Carbonate of lead, cerusse
Litharge
Wines and water impregnated with lead
Food cooked in leaden vessels
Syrups and spirits clarified with acetate of lead
Saturnine emanations

CLASS III.

Acrid Poisons.

Chlorine
Fluid chlorine
Nitrous acid gas
Sulphureous acid gas
Nitrate of potash
Veratrum album, white hellebore
Helleborus niger, black hellebore
Bryonia Dioica
Elaterium
Colocynth
Gamboge
Daphne Gnidium, spurge flax
Daphne Mezereum, &c.
Ricinus communis
Euphorbia officinarum, and several other species
Savine
Rhus radicans
Rhus toxicodendron
Rhus vernix
Anemone pulsatilla, &c.
Aconitum napellus, &c.
Chelidonium majus
Delphinium staphysagria
Narcissus pseudo-narcissus
Œnanthe crocata
Gratiola officinalis
Jatropha curcas
Scilla maritima
Sedum acre
Ranunculus flammula, and several other species
Rhododendron chrysanthum
Fritillaria imperialis
Pedicularis palustris
Cyclamen europæum
Plumbago europæa
Colchicum autumnale
Scammony
Gerbera ahovai
Cynanchum erectum
Lobelia syphilitica
Apocynum androsœmifolium, and other species
Asclepias gigantea
Hydrocotile vulgaris
Clematites vitalba, &c.
Pastinaca sativa annosa
Sœlanthus quadragonus, and other species
Phytolacca decandra
Croton tiglium
Arum maculatum, & other species
Calla palustris

CLASS IV.

Narcotic poisons.

Opium
Hyoscyamus niger
Hyoscyamus albus, &c.
Prussic acid
Prunus lauro cerasus
Oil of laurel
Bitter almonds
Lactuca virosa
The solana
Taxus baccata
Actæa spicata
Physalis somnifera
Azalea pontica
Ervum ervilia
Lathyrus cicera
Paris quadrifolia
Nitrogen gas
Nitrous oxide

CLASS V.

Narcotico-acrid

Atropa belladonna
Datura stramonium, &c.
Tobacco
Digitalis purpurea
Anagallis arvensis
Aristolochia clematitis
Conium maculatum
Cicuta virosa
Œthusa cynapium
Ruta graveolens
Nerium oleander
Upas Ticutè
Nux Vomica
Bean of St. Ignatius
Angustura pseudo-ferruginea
Upas antiar
Ticunas
Woorara
Camphor
Cocculus indicus
Poisonous mushrooms

Alkohol
Sulphuric æther
Carbonic acid gas
Gaseous oxide of carbon
Ergot, spurred rye
Lolium temulentum
Hippomane mancinella
Mercurialis perennis
Chærophyllum sylvestre
Sium latifolium
Coriaria myrtifolia
Odours of the above plants.

CLASS VI.

Septic or putrefying Poisons.

Sulphuretted hydrogen gas
Putrefied substances
Viper
Venomous snakes
Scorpion
Tarantula
Sting of bees, wasps, &c.
Poisonous fishes
Muscles
Malignant pustule
Rabies.

1. *Signs of poisons on the living body.*

A person is supposed to be poisoned, if, being in perfect health, he is attacked, after having taken some food or drink, with violent pain, cramp in the stomach, nausea, vomiting, convulsive action, and a sense of suffocation; or if he be seized, under the same circumstances, with vertigo, giddiness, delirium, or unusual drowsiness.*

All these symptoms may however be the effect of sudden disease, and the examiner should therefore recollect whether an epidemic or sporadic disease, resembling that of the patient, does not exist. He should also enquire into his strength, mode of life, and habit of body, and ascertain whether he had previously complained of ill health. The time at which the noxious substance was taken, and the vehicle in which it was given—the taste or odour that was perceived on its administration, and the food or drink that has been lately swallowed, are all subjects that require particular notice.

Having formed an opinion, from a review of the above circumstances, that a poisonous substance has been taken, the next question that arises is, to what class it belongs. Although (as I have already remarked,) the symptoms of poisons are somewhat

* These are the most striking *preliminary* symptoms. Mahon has collected a long list from the older writers, which, however, includes most of the appearances observed during the whole progress of the action of poisons. It is evidently too general to be of much practical value. See Mahon, vol 2, p. 263.

equivocal and unsettled, yet there are certain leading and characteristic appearances which in a majority of cases serve to distinguish the two great divisions of poisons from each other. And these two, are the *corrosive* or *acrid* and the *narcotic*.*

We may suppose a corrosive or acrid poison to be the cause of present disease, if the patient has observed that the food or drink, which was its vehicle, had not its ordinary taste—if he has felt a heat, an irritation or an extraordinary and sudden dryness at the root of the mouth and œsophagus, with a constriction or sense of strangling in those parts—if this be succeeded by an obstinate anxiety to vomit, and sharp pains in the stomach and intestines—if there be great thirst, copious discharges, by vomiting and by stool, accompanied with tenesmus and followed by hiccup, by a sense of constriction across the diaphragm, and a difficulty of breathing—if there be great pain in the region of the kidneys, followed by strangury—if convulsions, cramps of the hands, trembling of the lips, extinction of the voice, repeated faintings, cold sweats, and a small, chorded and irregular pulse be present; and if, in addition to all these, the intellectual faculties remain perfect, until the disease arrives near its fatal termination.†

A narcotic poison, on the other hand, produces the following effects : Stupor, numbness, a great inclination to sleep, coldness and stiffness of the extremities, a cold sweat of a fœtid or greasy nature, swelling of the neck and face, protusion of the eye with a haggard cast of countenance, thickening of the tongue, frequent vertigo, weakened eyesight, or objects presented to it, in a fantastic manner, coma, delirium,

* Although Orfila has followed the arrangement of Foderè, yet he explicitly states that the *corrosive* and *acrid* poisons produce phænomena precisely similar. Vol. 2, p. 1 and 521.

† Foderè, vol. 4, p. 190. Orfila, vol. 1, p. 15. vol. 2, p. 98, 514. "In general," (says the last author,) "the patient preserves the use of his intellectual faculties during the first periods, but a short time before death, he falls into a state of great insensibility and immobility, and is agitated by convulsive movements." He also mentions purple spots over the body, and a miliary eruption as occasional symptoms of this class.

general debility, palpitation of the heart, the pulse at first full and strong, but afterwards unequal and intermittent, paralysis of the lower extremities, retraction of the lips, general swelling of the body, and dilatation of the veins. At the conclusion of the disease, slight convulsions and pain are sometimes present.*

If we pursue the arrangement of Foderè, we shall find that the narcotico-acrid poisons are distinguished by a combination of several of the above symptoms. They are, agitation, pain, acute cries, sometimes stupor and convulsive motions of the muscles of the face, jaws and extremities—vertigo, and occasionally extreme stiffness of the limbs—and contraction of the muscles of the thorax—the eyes red and starting from their sockets, the pupils frequently dilated—insensibility to external impressions—mouth full of foam—tongue and gums livid—nausea, vomiting, frequent stools: often these symptoms attack in paroxysms, and the patient is left comparatively easy for a few moments.†

Lastly, astringent poisons, of which, lead is the most striking, are characterized by severe gripings in the stomach and abdomen, occasional vomitings, incessant cough, and wasting or paralysis. The absence of fever, and the protracted nature of the disease, unless very large quantities have been taken, appear also to be distinctive marks.

It may appear easy, after this enumeration, to distinguish the nature of the poison that has been taken, but in ordinary practice it is, notwithstanding, very difficult. There are substances very distinct in their characters which produce similar effects, as for example, cantharides, acrid vegetable substances, and caustic minerals. All these belong to the class of corrosives, and generally exhibit similar symptoms. The difficulty is increased, when it is recollected, that ordinary and innoxious substances, so far as concerns

* Foderè, vol. 4, p. 190. Orfila, vol. 2, p. 170, 515.
† Orfila, vol. 2, p. 367, 516.

their poisonous nature, sometimes cause the most alarming symptoms. Foderè observes, that he has seen a roasted chesnut produce all the symptoms of poison, until a dose of tartar emetic dispelled its influence.*

On the other hand, a variety is frequently observed in the symptoms excited by the same poison, on different individuals. Many causes may conduce to this, such as the mode in which it is exhibited. A poison given in the liquid form, is generally more rapid and marked in its effects than when it is exhibited in the solid state; and the substances previously or subsequently taken, may also modify the symptoms Instances of this variety are to be found in all authors on toxicology. Marc produced salivation in a dog, by giving him a large dose of opium, while sleep, the common consequence, was wanting.† So also Morgagni relates of a female, aged sixty, who had eaten a paste composed of milk and arsenic, which had been prepared for rats. She died in twelve hours after, but without having suffered any severe pains or convulsions. On dissection, however, her stomach was found eroded.‡

I apprehend that the circumstance of the patient's vomiting or not vomiting, has the greatest influence on the course and variety of the symptoms. This is a subject to which I shall have frequent occasion hereafter to refer, but it may be remarked at present, that there are many persons who vomit very readily, whilst in others the act is very difficult, and almost causes convulsions. In the former case, the poison may be rejected before it has time to produce injurious effects, while in the latter, death will be the inevitable consequence. And again, the poison, from the quantity taken, or for some other reason, may itself produce vomiting, and thus prevent the fatal ter-

* I shall notice this point more particularly at the conclusion of the section.

† Foderè, vol. 4, p. 195.

‡ Morgagni, vol. 2, epist. 59, p. 366.

mination. Dr. Petit, of Lyons, relates of a person who survived after taking half an ounce of arsenic, and he attributes this to the violent vomiting that ensued. Deschamps gives an account of a female who recovered after taking two drachms of tartar emetic, which was followed by vomiting; whilst another, who by buying small quantities from different apothecaries, had obtained eleven grains of the same salt, died from using it.* It is probable that large doses produce their effects early and violently, and the stomach endeavours to reject them as soon as perceived, while small ones seem to have time to act not only on the system generally, but also on the structure of parts.

A minute and accurate notice of symptoms is hence worthy of every attention, but it only forms the commencement of the enquiry in cases of supposed poisoning.

It is the further duty of the physician to examine every article of a suspicious nature, such as phials, boxes, or papers containing powders. These should be carefully put aside without remark. If the patient preserve his senses, we may obtain much necessary information from him, and possibly may also procure the remainder of the drink or substance that he has not completely taken. If this be impracticable, the matter vomited should be preserved, as also the linen or sponges used to collect the fluid which may have been deposited on the floor of the chamber, and a sufficient quantity should be sealed up, and reserved for the inspection of a competent chemist.

For a proper analysis of the matter vomited—of the matter found in suspected repositories, or the

* A still more striking case was mentioned in a Boston paper of the month of February, 1817. A man named *George Beals*, aged 21, and residing at Springfield, Mass. with an intent to destroy himself, swallowed at one draught, an ounce and a half of arsenic, immediately after having eaten a hearty supper of beefsteaks. He was seized instantly with violent vomiting, and was subsequently affected with spasm, but was restored to his usual health in three or four days. In about a month after, he destroyed himself by hanging.

matter found in the stomach or intestines, or both, after death, the following preliminary directions require attention. Never make any experiments on the suspected substance, without repeating them on ingredients that are deemed analogous, and in which the quantity of poisonous matter is ascertained. For this purpose, several solutions should be made of substances which it is supposed may probably resemble the poison given, and from the result, a comparison can be instituted. Again, the analysis should never be commenced until the tests are all prepared, and their accuracy determined. The order of proceeding should be previously laid down in the mind of the operator, and when ready, he should perform the experiments at one time. The risk of losing a part of the suspected substance, from employing inconclusive experiments, is thus avoided. Thirdly, if the quantity of matter received be sufficient, it should be divided into small portions, so that the various tests can be applied to each, but if there be only a very small quantity, the symptoms should be carefully considered, together with the indications they present, and an opinion should be formed as to the poison which most probably has caused the present disease. The tests applicable to it, should then be employed. In pursuing this examination, it is of little importance, comparatively speaking, whether a decisive opinion can be formed as to the *quantity* administered: it is sufficient to prove the *nature* and *quality* of the substance.*

Chemistry can thus lend its aid in detecting mineral substances, but it is insufficient in determining whether a vegetable poison has been taken. In such instances, a conclusion should be formed from the train of symptoms that are present, and the substance itself may also be evaporated, to ascertain the presence of resin or extractive matter. This is generally all that botany or chemistry can do, since although the ulti-

* Foderè, vol. 4, p. 199, 200, 201.

mate principles of vegetables be obtained, yet there is no certainty whether they belong to noxious or innoxious plants, except possibly in cases where the poison is of a ligneous nature, such as mushrooms, or where grains or berries are vomited.*

The kitchen utensils should always be noticed, since it may happen that a copper vessel badly tinned is the sole cause of these violent effects, and we should also remember, that the green colour which is frequently observed in the matter vomited, may be owing to vitiated bile, as well as to a mineral or vegetable poison.

It is an ancient direction, that part of the suspected substance should be given to some animal, in order to test its injurious nature. But the uncertainty of this proof has been shown in a former page, where it was mentioned, that many articles poisonous to man, are innoxious to animals, and it is therefore a point of considerable interest to ascertain on which of them it is most likely to produce effects similar to what it does on man. Physiologists generally recommend a dog as the subject, and Orfila says it should be a small, robust one, that is fasting. The suspected substance should not be put into his food, as is the ordinary practice, nor indeed should he be allowed to swallow it. This would produce the hazard of losing the whole by vomiting; and he hence advises, that the œsophagus should be detached, and perforated with a small hole. Into this a glass funnel is to be introduced, and the liquid poured through it into the stomach. The œsophagus is then tied below the opening. If the substance be solid, it should be put into a small paper cone, in order that it may be pushed down into the stomach through the opening. This, he adds, is the only method by which vomiting can be prevented, and the suspected substance exhibit its true character.† The testimony to be derived

* Mahon, vol. 2, p. 301.

† Orfila, vol. 2, p. 532. It has been objected to this mode of experimenting, that the operation on the œsophagus will destroy life, or produce al-

from this proof of poisoning, is, however, barely *presumptive.* The poisonous substance may be decomposed in the stomach of the patient by food or antidotes—it may have been rejected by vomiting, or it may have been absorbed, so as to leave a minute quantity in the intestinal canal; and in all these cases, the animal will probably escape uninjured. "Experiments of this kind, separately considered, possess no value, only as they present a positive result, that is to say, death; but we repeat again, they ought not to be regarded, even when well made, except as a secondary means, proper for corroborating the conclusions drawn from chemical analysis, symptoms, and lesions of texture."*

It must also be recollected, in connection with the circumstance under notice, that the human fluids, and particularly the *bile,* may, from disease, acquire such an acrimony as to be fatal to animals. Morgagni relates a remarkable instance of this kind. A child died of tertian fever, after having suffered violent convulsions. On dissection, the stomach was found to contain green bile, which tinged the scalpel of a violet colour. Having dipped the point of his instrument in the bile, he wounded two pigeons, who expired almost instantly in violent convulsions; and some of it, mixed with bread, was given to a cock, who also expired in a short time.†

Until now, I have considered the subject of poisoning persons in a state of health. I may add, that this is often attempted on individuals who are ill, and the difficulty of distinguishing the symptoms of disease from those of poison is proportionably increased. It may be said, that the disease has taken

terations of texture, but our author shows by numerous examples, that the ligature on this part in dogs, constantly produces, during the two first days, nothing more than a slight fever, and a little dejection, which is incapable of destroying them in so short a time; and also, that if animals be killed when in this state, no lesions will be discovered on dissection. if poisons, on the contrary, be introduced through the opening, their effects will be early manifested. Vol. 2, p. 482.

* Orfila, vol. 2, p. 535.

† Morgagni, vol 2, epist. 59, p. 396

a sudden turn—that the medicines used have been prejudicial, and that present appearances are a convulsive or final effort of the system. In such cases, attention to the following circumstances is required :

1. The sudden occurrence of symptoms which do not usually accompany the disease under which the patient labours. Thus, we should feel suspicious, if in an ordinary case, nausea, vomiting, hiccup, faintings, cold sweats, with bloody stools, should suddenly and rapidly follow each other; or again, if stertor, delirium, or insanity should supervene on a case of common disease.

2. Moral circumstances. The physician should never allow these to prejudice his mind, but he should never neglect noticing them. And I take this early occasion to say, that the physician is of all persons, the best judge concerning them. Let him ascertain whether an enmity does not exist between the sick person and some one who attends or visits him; if so, enquire whether any poisonous substances have lately been purchased—whether these are still in the house—whether the alarming symptoms came on immediately after taking a drink, or any other substance of an innocent nature—and particularly, ascertain whether any thing has been given without the orders of the physician, or by a person ignorant of medicaments.

A case or two will illustrate the subject before us. An individual aged fifty-six years, and subject to flatulence, took a bowl of chocolate and milk previous to starting on a journey. It was prepared by his daughter. He had advanced a very short distance, when he was seized with nausea, vomiting, and other severe symptoms, which obliged him to return home, and his death followed in nine hours after taking the chocolate. His body was not inflated—his visage was natural, but the nails were blue, and on his shoulders and breast were spots of the same colour. This disease was considered cholera morbus, but Hoffman, from whom the narrative is taken, believed

it to be the effect of arsenic rather than cholera, and for the following reasons : the symptoms which followed the use of the drink, such as copious vomiting, accompanied with a cadaverous paleness of the face, coldness of the extremities, great prostration of strength, poignant lancinating pain in the intestines, and the cessation of arterial action, and convulsions, all succeeded each other with greater rapidity than is observed in ordinary cholera morbus. Again, the daughter was at enmity with the father, who had punished her for living with her valet, and it was also known that she had previously purchased arsenic.*

In another case, an individual in ill health took some jelly, which his wife gave him to allay a colic. He felt nausea in a short time—breathed with difficulty—experienced severe pain in his stomach—vomited with great exertion a greenish bile, and finally died at the end of two days. He was buried on the third day after his decease, but was disinterred in twenty-four hours thereafter, from a suspicion that he had been poisoned by his wife. Putrefaction had advanced rapidly—the body was much swollen—the jejunum, mesentery, liver and lungs, were in a state of sphacelus—the heart was filled with black blood, resembling ink, and the stomach was in a gangrenous state near the pylorus, and contained a greenish coloured matter. Under these circumstances, the question of poisoning was supposed to be settled, and the woman was considered guilty. Hoffman, however, thought otherwise, from the following facts : the man had been ill for more than a year—his appetite was bad, and his strength impaired. On the morning of the day when he took the jelly, he complained of severe colic pains, and swallowed a large glass of brandy. After this, his wife had given him the jelly, and finding no benefit from it, he had again taken brandy, which also contained some heating substances. From this history, and also from knowing of no mo-

* F. Hoffman's Opera Omnia, vol. 3, sect. 2, chap. 8, p. 170.

ral circumstances against his wife, Hoffman believed that the disease alone would account for all these symptoms.*

These narratives will serve as illustrations of the comparison that should be made between the symptoms present, and those that ordinarily accompany the supposed disease. They are, however, greatly defective in other respects, inasmuch as dissection in the one instance, and chemical analysis in both, appear to have been omitted.

If difficulties and doubts envelope the discovery of poisons, whose distinguishing character is the rapidity of their effects, how much greater must be the uncertainty when we are required to ascertain the administration of what are called slow poisons. This subject indeed is so closely entwined with popular superstition, that it is difficult to seperate truth from falsehood. In Italy, for example, it was formerly said that poisons were invented to destroy life at any stated period—from a few hours to a year.† This

* Hoffman ut supra, p. 171. Both these cases are quoted by Foderè; and this author relates an instance within his own observation, where the exhibition of a dose of epsom salts was orderd by the physician, and the husband gave it to his wife. It was followed by all the symptoms of narcotic poison, and death ensued in a short time. From his libidinous habits and the symptoms present, there was no question that he intended to poison her, and accordingly had substituted opium. Foderè, vol. 4, p. 212. The duty of the physician is certainly very clear in these cases.

† We are indebted to Professor Beckmann for a very elaborate article on this subject, in which he has concentrated nearly all that is known concerning *secret poisoning*. Of this, I shall present an abstract, aided with some facts from other sources. He considers it unquestionable, that the ancients were acquainted with this kind of poison, and thinks it may be proved from the testimony of Plutarch, Quintillian, and other respectable authors. The former states that a slow poison, which occasioned heat, a cough, spitting of blood, a consumption, and a weakness of intellect, was administered to Aratus of Sicyon. Theophrastus speaks of a poison prepared from aconite, which could be moderated in such a manner as to have effect in two or three months, or at the end of a year, or two years; and he also relates, that Thrasyas had discoverd a method of preparing from other plants a poison, which, given in small doses, occasioned an easy but certain death, without any pain, and which could be kept back for a long time without causing weakness or corruption. This last poison was much used at Rome, about two hundred years before the Christian æra. At a later period, a female named Locusta, was the agent in preparing these poisons, and she destroyed in this way, at the instigation of Nero, Britannicus, the son of Aggrippina.

The Carthaginians seem also to have been acquainted with the art of poisoning; and they are said, on the authority of Aulus Gellius, to have

however is a mere fiction, and it is now well understood, that we know of no substances which will produce death at a determinate epoch. But I shall have occasion in the next section, when stating the case of the late Prince Charles, of Augustenberg, to show that the idea of slow poison is still prevalent, even among the physicians of continental Europe.

administered some to Regulus, the Roman general. Cotemporary writers, however, it must be added, do not mention this.

The principal poisons known to the ancients, were prepared from plants, and particularly aconite, hemlock and poppy, or from animal substances, and among the latter, none is more remarkable than that obtained from the sea-hare, (*Lepus marinus*, or *Aplysia depilans* of the Systema Naturæ.) With this, Titus is said to have been dispatched by Domitian. They do not seem to have been acquainted with the common mineral poisons.

In the year 1659, during the pontificate of Alexander VII. it was observed at Rome, that many young married women became widows, and that many husbands died when they became disagreeable to their wives. The government used great vigilance to detect the poisoners, and suspicion at length fell upon a society of young wives, whose president appeared to be an old woman, who pretended to foretell future events, and who had often predicted very exactly the death of many persons. By means of a crafty female, their practices were detected—the whole society were arrested and put to the torture, and the old woman, whose name was Spara, and four others, were publicly hanged. This Spara was a Sicilian, and is said to have acquired her knowledge from Tofania at Palermo.

Tophania, or Tofania, was an infamous woman, who resided first at Palermo, and afterwards at Naples. She sold the poison, which from her acquired the name *Aqua della Toffana*, (it was also called *Acquetta di Napoli*, or *Acquetta* alone,) but she distributed her preparation by way of charity to such wives as wished to have other husbands. From four to six drops were sufficient to destroy a man, and it was asserted, that the dose could be so proportioned as to operate in a certain time. Labat says, that Tofania distributed her poison in small glass phials, with this inscription, *Manna of St. Nicholas of Bari*, and ornamented with the image of the saint. She lived to a great age, but was at last dragged from a monastery, in which she had taken refuge, and put to the torture, when she confessed her crimes, and was strangled.

In no country, however, has the art of poisoning excited more attention than it did in France about the year 1670. Margaret d'Aubray, wife of the Marquis De Brinvillier, was the principal agent in this horrible business. A needy adventurer, named Godin De Sainte Croix, had formed an acquaintance with the Marquis during their campaigns in the Netherlands—became in Paris a constant visitor at his house, where in a short time he found means to insinuate himself into the good graces of the Marchioness. It was not long before the Marquis died, not, however, until their joint fortune was nearly dissipated. Her conduct, in openly carrying on this amour, induced her father to have Sainte Croix arrested and sent to the Bastile. Here he got acquainted with an Italian, of the name of Exili, from whom he learnt the art of preparing poisons. After a year's imprisonment, Sainte Croix was released, when he flew to the Marchioness, and instructed her in the art, in order that she might employ it in bettering the circumstances of both. She assumed the appearance of a nun, distributed food to the poor, nursed the sick in the Hôtel Dieu, and tried the strength of her poisons undetected on these hapless wretches. She bribed one Chaussèe, Sainte Croix's servant, to poison her own father, after introducing him into

There is however a certain class of poisons, which are slower in their operations, and may hence more readily be confounded with the effects of disease. And these belong to the astringent kind. It is also possible that minute portions of the acrid poisons administered from time to time, may gradually cause irreparable injury to the digestive and lymphatic sys-

his service, and also her brother, and endeavoured to poison her sister. A suspicion arose that they had been poisoned, and the bodies were opened, but no detection followed at this time. Their villainous practices were brought to light in the following manner: Sainte Croix, when preparing poison, was accustomed to wear a glass mask; but as this happened once to drop off by accident, he was suffocated, and found dead in his laboratory. Government caused the effects of this man, who had no family, to be examined, and a list of them to be made out. On searching them, there was found a small box, to which Sainte Croix had affixed a written request, that after his death it might be delivered to the Marchioness De Brinvillier, or in case she should not be living, that it might be burnt. This request was as follows: "I humbly beg that those into whose hands this box may fall, will do me the favour to deliver it into the hands only of the Marchioness De Brinvillier, who resides in the Street Neuve St. Paul, as every thing it contains concerns her, and belongs to her alone, and as besides, there is nothing in it that can be of use to any person except her; and in case she shall be dead before me, to burn it, and every thing it contains, without opening or altering any thing; and in order that no one may plead ignorance, I swear by the God whom I adore, and all that is most sacred, that I advance nothing but what is true. And if my intentions, just and reasonable as they are, be thwarted in this point, I charge their consciences with it, both in this world and the next, in order that I may unload mine, protesting that this is my last will. Done at Paris, this 25th May, in the afternoon, 1672. *De Sainte Croix.*" Nothing could be a greater inducement to have it opened, than this singular petition, and that being done, there was found in it a great abundance of poisons of every kind, with labels, on which their effects, proved by experiment on animals, were marked. The principal poison, however, was corrosive sublimate. When the Marchioness heard of the death of her lover and instructor, she was desirous to have the casket, and endeavoured to get possession of it by bribing the officers of justice, but as she failed in this, she quitted the kingdom. La Chaussèe, however, continued at Paris, laid claim to the property of Sainte Croix, was seized and imprisoned, confessed more acts of villainy than was suspected, and was, in consequence, broken alive on the wheel, in 1673.

The Marchioness fled to England, and from thence to Leige, where she took refuge in a convent. Desgrais, an officer of justice, was despatched in pursuit of her, and having assumed the dress of an abbe, contrived to entice her from this privileged place. Among her effects at the convent, there was found a confession, and a complete catalogue of all her crimes, in her own hand-writing. She was taken to Paris, convicted, and on the 16th of July, 1676, publicly beheaded, and afterwards burnt.

The practice of poisoning was not, however, suppressed by this execution, and it was asserted, that confessions of a suspicious nature were constantly made to the priests. A court for watching, searching after, and punishing prisoners, was at length established in 1679, under the title of *Chambre de poison*, or *Chambre ardente*. This was shortly used as a state engine against those who were obnoxious to the court, and the names of individuals of the first rank, both male and female, were prejudiced. Two

tem, and finally destroy life. In such cases, the physician should not mistake a disease or the effects of a bad constitution, for the consequences of the exhibition of noxious substances. The symptoms of the individual should be noticed for a length of time—and the state of his health previous to the last illness should be well understood. It is also important to

females, La Vigoreux and La Voisin, were burnt alive by order of this court, in Feb. 1680. But it was abolished in the same year.

Professor Beckmann relates the following, as communicated to him by Linnæus : " Charles the XI. king of Sweden, having ruined several noble families by seizing on their property, and having after that, made a journey to Torneo, he fell into a consumptive disorder, which no medicine could cure. One day he asked his physician in a very earnest manner, what was the cause of his illness. The physician replied, " Your majesty has been loaded with too many maledictions." " Yes," returned the king, " I wish to God that the reduction of the nobility's estates had not taken place, and that I had never undertaken a journey to Torneo." After his death, his intestines were found to be full of small ulcers."

There has been great diversity of opiniou as to the nature of these poisons. That prepared by Tofania, appears to have been a clear insipid water, and the sale of aquafortis was for a long time forbidden in Rome, because it was considered the principal ingredient. This, however, is not probable. In Paris, the famous *poudre de succession*, (also a secret poison) was at one time supposed to consist of diamond dust, pounded exceedingly fine ; and at another, to contain sugar of lead, as the chief ingredient. Haller was of this last opinion. In the casket of Sainte Croix, were found sublimate, opium, regulus of antimony, vitriol, and a large quantity of poison ready prepared, the principal ingredients of which the physicians were not able to distinguish. Garelli, physician to Charles VI. king of the two Sicilies, at the time when Tofania was arrested, wrote to the celebrated Hoffman, that the *Aqua Tofania* was nothing else than crystallized arsenic, dissolved in a large quantity of water by decoction, with the addition, (but for what purpose, he knew not,) of the herb *cymbalaria*, (probably the *Antirrhinum cymbalaria.)* And this information, he observes, was communicated to him by his imperial majesty himself, to whom the judicial procedure, confirmed by the confession of the criminal, was transmitted. But it was objected to this opinion, that it differed from the ordinary effects of arsenic, in never betraying itself by any particular action on the human body.

The Abbe Gagliani, on the other hand, asserts that it is a mixture of opium and cantharides, and that the liquor obtained from its composition, is as limpid as rock water, and without taste. Its effects are slow, and almost imperceptible. Beckmann appears to favour this idea, and suggests that a similar poison is used in the east under the name of *powst*, being water which had stood a night over the juice of poppies. It is given to princes, whom it is wished to despatch privately, and produces loss of strength and understanding, so that they die in the end, torpid and insensible. (Beckmann, vol. 1, p. 74 to 103, Smith, p. 195. London Monthly Mag. vol. 14, p. 515. Metzger, p. 386, 402.)

The following extract will show that *secret poisoning* has penetrated into the forests of our own country. " The celebrated chief, *Black Bird*, of the Omawhaws, gained great reputation as a medicine man ; his adversaries fell rapidly before his potent spells. His medicine was arsenic, furnished him for this purpose by the villainy of the traders." Major Long's Expedition, vol. 1, p. 226.

ascertain whether some impropriety in food or medicine has not led to the present result, and a comparison may be made with the known effects of slow poison—first a depraved and then a destroyed appetite—weakness, marasmus, depression of spirits, a slow fever, chills and heat, &c. Lastly, dissection should exhibit appearances distintly referable to the supposed noxious cause.*

Poisons may also be administered to several persons at once, as at an entertainment, and the symptoms that follow, be so various, as to render the cause doubtful, were it not understood that such consequences are of frequent occurrence. I shall endeavour to illustrate this point by some cases.

In the month of May, 1711, four individuals, viz. a priest, two females, one of whom was his sister-in-law, and another person, all in good health and on a journey, stopped at an inn to dine. They proceeded on their journey after taking this meal, but in a short time the priest was seized with such violent pain, as to oblige him to dismount from his horse. Copious evacuations by vomiting and stool succeeded, and his illness increased so rapidly, that it was found necessary to take him back to Cesenne, the place where they had dined. A physician was called in, who conceiving the complaint to be only an ordinary colic, treated it with fomentations, glysters, purgatives and anodynes. During this time, one of the females was seized with severe pain and weakness, accompanied with copious evacuations. The fourth person of the party also complained of pain and weight at the stomach; but notwithstanding this, the physician had no suspicion of poison, since the other female was in perfect health, and the landlord protested that there could have been nothing noxious in his dishes. On the next day they were all somewhat better, and were enabled to arrive at a place

* Foderè, vol. 4, p. 226. Mahon, vol. 2, p. 316. Orfila, vol. 2, p. 552. The latter relates some cases of slow poisoning, which I shall hereafter notice when considering individual poisons.

near where Morgagni resided, for whom they immediately sent. This great physician, having learnt the circumstances, immediately enquired whether there was not some dish on the table, of which the female in good health had not eaten. He was answered in the affirmative, and it was ascertained to have been a large dish of rice, served up at first. He settled in his own mind, that there were poisonous materials in this dish, but the difficulty was, why the priest who had eaten the least, should have suffered the most, while the female who had eaten a larger quantity was not so ill; and finally, that the fourth person who had eaten more than all the rest, had only some pain in his stomach. Was there not, said Morgagni, some cheese grated over this rice? They answered in the affirmative, and the priest, who had little or no appetite, ate scarcely any thing but the cheese; the female ate both cheese and rice, while the other person ate the rice, with scarcely any cheese. Then said Morgagni, the state of the case is, that the cheese was prepared with arsenic to kill rats, and not having been laid away with sufficient care, it was served up for your rice, while you where hurrying the landlord for your dinner. This opinion was verified by the confession of the landlord himself, who learning that the patients were out of danger, avowed that such was the cause of the accident.

At a banquet, numerously attended, a dish was brought in during the desert, in which arsenic had been used instead of meal. Those of the guests who had eaten or drank but little, died in a few hours, whilst those who had eaten considerably, were saved by copious vomiting. Some lived for several years, and when examined after death, *the cicatrices of large ulcers were found in their stomachs.*

In another instance, a boy two years old, and two adult females, partook of some soup in which arsenic was mixed. The boy took only two spoonfuls, but it was on an empty stomach; whilst the females, who had already eaten, took the remainder of it. They

vomited copiously, and survived; whilst the other did not vomit and died, and on dissection, his stomach was found ulcerated.*

From these, and several other cases related by Morgagni and Hoffman, Foderè draws the following conclusions. 1. In such instances, the physician should enter into the most minute details concerning every thing that has passed at the meal. Enquire whether every one eat from all the dishes, and in what quantity—what kind of meats were sat down, and what wines drunk. 2. That very different effects ensue from taking poison on an empty or on a full stomach; and hence Baccius, he says, recommends to those *who fear being poisoned at a banquet, first to eat and drink a considerable quantity.* This precaution was doubtless not an idle one in some of the capital cities of continental Europe, and one effect of it certainly is, that it protects the stomach to a certain degree from the activity of the poison, and also facilitates vomiting. The practice of mountebanks, who pretend to sell antidotes to arsenic, is said to be in conformity with this direction. They first fill the stomach with milk or oily fluids, and then swallow the arsenic in public. In secret, however, they shortly throw it up again, and sometimes it proves fatal when retained too long. 3. It may sometimes be necessary to enquire of what kind of dainties the poisoned persons were most fond, since murderers have sometimes taken advantage of a known partiality. 4. It is evidently no reason that a certain article of food or drink is not poisonous, because some individuals have taken it without inconvenience. We have already seen the difference between vomiting and not vomiting. The greater the quantity of poison taken, the more is there a hope of escaping; whilst those who feel no immediate ill effects, are often the earliest victims. Both descriptions of persons should be examined, and the matter vomit-

* Foderè, vol. 4, p. 242, 244. These cases are quoted from Morgagni—*de Causis et Sedibus Morborum*, epist. 59.

ed should be analyzed, in order to detect the nature of the poison.*

It is a very difficult question to determine whether poisoning is the result of suicide or homicide. We can only form an opinion from moral considerations, and a notice of the following is recommended by Foderè. The previous state of mind of the deceased—whether he has been subject to delirium; also if he has not met with losses—has been disappointed in his hopes, or is suffering under disgrace. Also, whether any of the persons with whom he lived or associated, had any interest in his death. The season of the year also deserves consideration. He observes, that suicides are most frequent during the period of the solstices and the equinoxes. We should also ascertain whether the patient, instead of complaining, remains quiet, seeks solitude, and refuses the aid of medical men and of medicines. Any kind of writing left by the individual, to express his last wishes, as it is the most common, so it is also the most certain proof of self-destruction. But the finding a part of the poison in the room or in his pockets, is evidently a very equivocal proof, since it may quite as easily be put there by others as by himself.†

It may sometimes happen that a false accusation of poisoning is brought, and that great illness is pretended. In such instances, the complainer should be tested by the rules already laid down, and a long examination will scarcely ever be necessary in order to develope the deceit.

I shall conclude this section with a notice of the diseases and symptoms that are most likely to be mistaken for the effect of poisons; and they probably are idiosyncracy, indigestion, and sudden illness.

* Foderè, vol. 4. p. 240 to 248. Orfila, vol. 2, p. 548.

† Foderè, vol. 4, p. 248. Smith, p. 274. Metzger observes, "La seule prèsomption physique, (of suicide) est la quantitè considerable du poison englouti, dont le gout nauseabond eüt certainement excitè le vomissement, s'il eût ètè administrè par une main etrangère. Les poisons vegetaux entrainent presque toujours l'idee d'imprudence, et excluent consequemment, dans le plus grand nombre des cas, celle de suicide; l'opium seul est communèment mis àvec connoissance de cause en usage." P. 148.

Idiosyncracy is an inexplicable circumstance in the animal economy, but however extraordinary it may appear at first sight, yet it is no less true that individuals will have an antipathy to some particular article of diet; and in some instances, the bare seeing of it, and in others the eating of it, produces the most alarming consequences. Cheese, and various other articles have produced such effects. But the most striking cases of resemblance to the effects of poison, probably occur in those who, after being long accustomed to a particular species of food, for the first time use another kind. The town of Martigues in France is almost altogether inhabited by fishermen, who have lived on fish since their infancy. Foderè, during the first year of his residence there, often prescribed meat soups to his sick, but in every instance, their administration was followed by violent nausea and vomiting. They confessed that it was the first time they had used any aliment prepared from meat.

Next as to indigestion. Extraordinary instances will often occur, in which symptoms the most violent and uncommon, suddenly exhibit themselves. This is particularly the case with those who live in a luxurious manner, eat mushrooms and truffles, or shell fish, in peculiar seasons of the year. A violent pain comes on, the stomach is attacked with spasmodic constriction, green matter is vomited, and we would certainly believe a poison had been maliciously administered, did we not know how vitiated the bile may become, and what powerful efforts are necessary in a weak stomach to throw off indigestible food. It is proper to recollect that such symptoms may occur even in the midst of a repast, and caution is hence required, so as not to confound the cause with the effects of poison.

On the subject of sudden illness and death, more will be said in the next section. At present, the following circumstances may be recommended as worthy of attention. 1. The season of the year and the prevailing epidemic. Thus cholera morbus rages in

the summer and autumn, and as colic and vomiting may then be said to be epidemic, we would not of course be so much surprised at their sudden appearance, as if they came on in winter. 2. The former habits of the patient; his mode of life and state of health should be ascertained, and we should learn if possible, whether he has no concealed disease. Sudden death is sooner to be expected in a valetudinarian, than in one who has previously enjoyed perfect health. 3. We should notice whether fever be present or not. It is an uncommon circumstance, that internal disease of a fatal kind, and of the nature we are now noticing, is present without more or less fever. Poisons, however, during their first operation, are not accompanied with it.*

2. *Signs of poison on the dead body.*

In many instances, the medical examiner is not called until the stage now about to be considered. The illness may have been sudden and rapid; it may have been difficult to procure medical aid, and thus the opportunity has been lost of comparing the symptoms with the appearances found on dissection. If such be the case, he should be guided solely by the phœnomena that present themselves during the inspection.

In addition to the rules already laid down in a former chapter concerning medico-legal dissection, it is proper to observe, that the mouth, larynx and trachea should be examined—and after opening the abdomen, the liver should be raised, so as to view its concave surface, the gall-bladder and a portion of the stomach. The spleen, pancreas, intestinal canal and mesentery, should all be noticed. Ligatures are then to be applied to the œsophagus and rectum, and the parts included within them removed from the body. This precaution is absolutely necessary to

* Foderè, vol. 4, p. 289 to 297.

prevent the loss of any fluids contained in the alimentary canal.

After being thus removed, it should be opened throughout its whole extent, and the fluids and solids contained in it should be collected in proper vessels. The whole internal surface must then be washed with distilled water, which must likewise be preserved. The lesions observed should be noted and all the inflamed or gangrenous portions detached with a scalpel If there be any perforations, the parts round the holes should be taken out and the solid portions preserved in alkohol. And it is highly important, in this case, previously to absorb with a sponge all the fluid contained in the abdomen, and afterwards to deposit it in proper receptacles for future analysis.*

This examination should be made in the presence of a magistrate, and every fact should be recorded by a secretary in the order of its notice.

The next subject of inquiry is, the class of poisons which the appearances on dissection seem to indicate.

The corrosive or acrid poisons, generally produce inflammation of the first passages, constrictions of the intestinal canal, gangrene, sphacelus and perforations of the parts. The inflammation however varies as to extent and intensity. Sometimes it affects the mouth, œsophagus, and more particularly the stomach, and extends to the duodenum, while in others it reaches through the whole space of the digestive tube. Again, the membranes are sometimes of a clear red colour, without any trace of ulceration, sometimes of a cherry red, with longitudinal or transverse patches of a blackish colour, formed by extravasated blood between the coats. Ulcerations are observed in various parts, but particularly near the pylorus.

Another character of these classes of poisons, is the separation of the mucous or villous coat of the stomach from the muscular, in such a manner that it and the

* Orfila, vol. 1, p. 72. vol. 2, p. 519.

serous remain perfectly isolated. Hebenstreit mentions this as a striking proof, and his opinion is adopted and advocated by Mahon and others.* The latter remarks, that such a separation cannot take place, without some corrosive substance has been applied to the internal surface of the stomach, for it is impossible to believe that putrefaction could produce such an effect, and the folds and rugosities of the internal coat would not permit this sudden separation except from some powerful cause.† He therefore insists on it as a most positive proof, and his opinion has met with the acquiescence of Foderè and Orfila.

Again, the action of these poisons is sometimes extended to the other viscera, and the skin becomes covered with black spots, resembling gangrene. Morgagni mentions the case of a woman poisoned with arsenic, and who had experienced very little pain from it, whose body, notwithstanding, was entirely black after death, on its posterior surface from head to foot, while the lungs were gangrenous, and the stomach and duodenum perforated.‡ In general, the lungs are of a deeper red than in the natural state, and it is not uncommon to find in them a bloody serosity.

These are the ordinary effects of corrosive or acrid poisons.‖ The variations occasionally observed, we shall hereafter notice, but it is proper to add in this place a remark from Baillou. He states, that in cases of sudden death, poison is often deemed the cause, if on dissection the left side of the lower part of the stomach contains dark-coloured spots. But this

* "Corrosiva venena—illum rodunt, dissecant, vulnerant, et primario quidem illam ejus internam tunicam, quæ villosa dicitur, destruunt, atque ab substrata altera, *vasculari* seu *nervea* dicta, avellunt," &c. Hebenstreit, p. 498.

† Mahon, vol. 2, p. 289. He suggests that similar appearances may *possibly* be observed on the crisis of certain atrabiliary diseases; but in this instance, the previous symptoms of the patient, with the correspondent lesions found on dissection, will readily distinguish the cause.

‡ Morgagni, vol. 2, epist. 59, p. 367.

‖ Foderè, vol. 4, p. 262. Orfila, vol. 1, p. 15. vol. 2, p. 98, 520. The last author has conclusively proved, that corrosive and acrid poisons produce lesions of texture precisely alike.

should not be attributed to external causes, since it is caused by the blood itself which settles in the branches of the vasa brevia at death. On the other hand, however, the slightest and smallest holes or erosions in the stomach should be carefully examined; and this will be best effected by holding the viscus between the eye and the light, as by doing so, many apertures in its substance have been found, which otherwise would elude observation.*

The effects of narcotic poisons, are generally stated to be the following: a rapid tendency to putrefaction, evidenced by large spots on the skin, of a red or livid colour; a red, swollen, or livid countenance; flexible extremities; the blood in a fluid state, and effused in various parts, and the stomach and intestines touched with sphacelus, without any inflammation.† Orfila, contradicts the correctness of several of these. He has frequently observed, that putrefaction was not advanced more than usual at twenty-four, or even thirty-six hours after death; that the limbs were as stiff as in those who had been poisoned by substances of another class, and that the blood was coagulated a short time after death. On dissection, no traces of inflammation were found by him in the digestive canal of animals killed by narcotics, and he attributes such appearances to the subsequent administration of substances capable of producing inflammation. The lungs, however, present almost constantly livid and even black spots, and their texture is more dense and less crepitating. The brain also often exhibits distention of its veins.‡

As to the narcotico-acrid, it may be remarked, that there are some which are capable of exciting a severe inflammation, accompanied with ulceration or gangrene, while others do not inflame. The lungs, blood, brain, and other organs, present, in general, the same alterations as are induced by the narcotics.

The astringent poisons, of which lead is the pri-

* Foderè, vol. 4, p. 269.
† Ibid. p. 258.
‡ Orfila, vol. 2, p. 171, 522.

mary one, when taken in the form of salts, produce inflammation of greater or less vehemence, and sometimes black points or spots are seen, caused by the extravasation of venous blood. Saturnine emanations, on the contrary, produce no inflammation, but the intestinal canal, and particularly the colon, is contracted in its diameter.

The reader must not, however, suppose, that the lesions now described, are the invariable results of the respective kinds of poison. On the contrary, a great variety in this respect has been noticed. Thus Marc, in a case of poisoning by arsenic, found the membranes of the stomach *thickened* instead of *eroded*.* And what is still more extraordinary, there have been cases where the exhibition of acrid and corrosive poisons have left no marks of disease in the stomach or intestinal canal. Morgagni, Wepfer and Brunner, mention instances of this nature, and Sauvages speaks of a person who died suddenly after a violent epileptic fit, from swallowing fifteen berries of the sumach. Ten were ejected by vomiting, and the remaining five were found in the stomach after death. Notwithstanding this, the stomach exhibited no marks of lesion, nor was any other part of the body diseased. Etmuller mentions the following remarkable occurrence. A young girl having taken arsenic, vomited considerably during the night, and on the next morning was found dead. The skin was of a livid blue colour, but no appearances of disease could be found on dissection. There was no inflammation or gangrene present, yet in the stomach a white powder was observed, which, on being thrown on the coals, gave out a thick smoke with an arsenical odour. Powders containing a similar substance were found in the house, part of which was given to a dog, with fatal effects, and on dissection the stomach was found extensively inflamed. It is conjectured by the reporter, that the poison having been taken

* Marc, p. 66.

on a full stomach, may have prevented its usual chemical action.*

It has been supposed, in explanation of these anomalies, that such poisons as are given in the form of powder, will more readily cause destructive effects on the stomach, than those which are soluble. We are, however, not in possession of sufficient facts to explain satisfactorily the great variety that is occasionally observed; and experiments, so far as they have proceeded, do not permit us to assign that as the general cause.†

Having examined the stomach and intestines, and noted their appearance, the next circumstance that requires attention, is the collecting of the poison (if there be any) from those organs. And it is in this direction that modern medical jurisprudence so much exceeds ancient forms. Nothing can be stronger proof, nothing will convict the criminal in a more satisfactory manner, than the discovery of the poison in the body of the deceased, and the subsequent detection of it by chemical tests.

In a number, possibly in a majority of cases, this search will be unsuccessful, and the cause of this has been already intimated. Murder is attempted by administering large doses of poison, and in some individuals, these produce copious vomitings, which indeed is often assisted by the deceased drinking copiously. Hence the chance of finding the poison is diminished, as it may have been rejected. But all the solid or fluid substances that are found, should be collected with care, preserved in proper vessels, and transmitted to a competent chemist, for deliberate examination. The distilled water with which the internal surface of the stomach is washed, also requires investigation.‡

* Foderè, vol. 4, p. 272, 273.

† Orfila, vol. 2, p. 521.

‡ It is not necessary in this place to advert to the various tests, as these will be particularly mentioned under the head of mineral poisons, and I shall conclude the notice of that class by a classification of the results to be deduced from them.

While chemistry can thus aid in detecting mineral poisons, it is of comparatively little value in discerning the nature of vegetable substances. The form, colour and smell of the supposed poison, should, however, be noticed, and it is possible that traces of it may remain in the stomach, but slightly altered from their natural state. By a comparison with the previous symptoms, and by submitting these to the inspection of a skilful botanist, we may possibly arrive at the truth. In all cases, the medical jurist should recollect, that he has but half performed his duty, if he does not call to his assistance all that knowledge which attention to particular sciences can afford. If he does not avail himself of it, he may rest assured that the criminal will escape, to the discomfiture of the ends of justice, and the disgrace of the profession.

Having already mentioned the animal to which it will be proper to administer a portion of the noxious substance, it is only necessary to add, that soon after its death, the stomach should be examined, and a statement taken of the lesions that are observed.

All the dissections of which we have spoken, will be most satisfactory and conclusive, if the examination be made in as short a time as possible after death, since putrefaction generally commences in the viscera of the abdomen—the very organs that require the most critical examination. It is difficult, in cases of incipient or actual gangrene, to distinguish the spots or blotches produced by it, from those that are caused during life. Mahon, however, suggests the following distinction, which is evidently founded in truth. "If the stomach preserves its natural colour, and the spots on it are marked with red, while the borders of ulcers are also of a vivid or pale red colour, we are sure that the cause has operated during life; but if the stomach and its spots are livid and pale, we should attribute the appearance to putrefaction, and attach no value to it."*

* Mahon, vol. 2, p, 315.

Notwithstanding these difficulties, it is a common occurrence, that the bodies of persons supposed to be poisoned, are dug up several days after death, for examination. In such cases, before investigating the particular instance, the season of the year, its dryness or humidity, the winds, and indeed every thing that can be more or less favourable to the preservation of dead bodies, should be considered. It is certainly established beyond a doubt, that a body buried for a length of time will be more free from putrefaction, than another that has been kept unburied for the same space. It may also happen, that the poison given has been of a drying nature, and of a kind that seems to delay decomposition. Corrosive sublimate is said to do this, and if we notice any thing of such a nature, it should be mentioned in the report. As a general rule, the examination of bodies in this situation should not be totally neglected. The medical jurist has only a more difficult task to perform. He must state the circumstances that are present—mention the progress of putrefaction, and clearly explain in what respects it prevents the examination from being satisfactory or conclusive.

Nor must it be forgotten, that the use of some innocent substances during life, may cause appearances of a suspicious nature, and which therefore strongly illustrate the necessity of understanding the previous history of the patient. The following case from Foderè, will tend to illustrate this remark. A person at Chalons sur Marne, was just recovering from a severe sickness, and during his convalescence, took a gentle laxative, after the operation of which, he suddenly died. He was supposed to have been poisoned through the negligence of the apothecary, and to ascertain this, the body was opened. The stomach and œsophagus were found red, and in some places livid, and resembling gangrene. Here the investigation stopped, and the patient was looked upon as evidently poisoned. M. Varnier, a physician at Chalons, knowing the exactness and prudence of the apothe-

cary, felt, however, strong doubts concerning the cause of death, and on reflection, determined that the convalescence had been only an insidious respite. But it was necessary to assign a reason for the colour of the œsophagus and stomach, and having learnt that the deceased had been in the habitual use of a strong infusion of red poppies *(coquelicots)* for some time, the idea struck him that this might be the cause. To ascertain the fact, he gave a similar infusion to a dog for some time, and on dissection, found that the organs above mentioned were precisely of the same colour as on the body of the person supposed to be poisoned. So deep indeed was it, that it resisted repeated ablutions.*

This case teaches us a useful lesson in legal medicine, viz. that the fluids and solids may be coloured by various alimentary substances or medicaments, if their use be long persisted in; and it also gives a caution, not to depend too much on a single phænomenon, but to view all the known facts in connection, and then deduce a judgment from them.

In the general remarks on poisons, it was mentioned that they might be introduced into the system by means of injection, and I repeat it at this time, for the purpose of enforcing the direction of examining the whole intestinal canal from the mouth to the rectum. If this noxious substance be thrown up in the above manner, it will of course be in vain to look for its indications in the stomach or smaller intestines.

The wife of a receiver general of taxes in the department of Arriege, was attacked some years since (in 1807) with a slight illness, which rapidly terminated in a severe and fatal one. On dissection, the intestines were found in a state of high inflammation. A servant girl was arrested on suspicion, and it appeared that she had mixed twenty-four grains of tartar emetic in the tisan or drink of her mistress, and afterwards had boiled an ounce of arsenic with the

* Foderè, vol. 4, p. 282.

liquid prepared for an injection. Previous to her execution, she confessed, that not finding the tartar emetic sufficiently active, she administered the arsenic.*

But there is a more difficult case, somewhat connected with this point, which deserves the most deliberate investigation. It is the atrocious villainy of introducing a poisonous substance after death, with a view of accusing an innocent person of the crime. Such an act is said to have been committed in Sweden, and it will readily occur, that if a corrosive substance be injected *per anu*, it may leave an inflammation sufficiently marked to lead the uninformed observer to the supposition that murder has been perpetrated.

So important a subject has not escaped the investigation of Orfila. He instituted experiments with corrosive substances on the dead bodies of men and dogs, and the result has established certain definite and fixed characters.† Several dogs were hung, and a short time after death a quantity of corrosive sublimate, in the form of powder, and in small fragments, was introduced into the rectum. On examination, the mucous coat of the intestine near the anus, exhibited several folds of a clear rose colour, but immediately above them, the rectum was of its natural colour, so that there was *a line of demarcation perfectly established between the parts to which the sublimate had been applied, and those which had not been in contact with it.* The same experiment performed on a living dog, presented, on dissection, an intense redness, which extended eight inches, *gradually* diminishing in intensity, and left no distinct line of demarcation. Similar effects were produced with arsenic. Verdigris, however, left no trace of demarcation or ulceration on the rectum of the dead dog, while it corroded the living parts. The sulphuric and nitric acids

* Foderè, vol. 4, p. 266.

† He did not deem it necessary to experiment with the narcotics or narcotico-acrid, as the former do not produce any local lesion after death, and the latter only cause a slight degree of it.

produced no other effect than their chemical one, and the lesions that indicate reaction in the system, such as inflammation and redness, were absent. Dr. Tartra found that he could produce on the dead, as well as on the living, that yellow or orange colour, which is the characteristic of nitric acid. The stomach was rendered rotten by it, but in all his experiments on the dead, the striking distinction was wanting, viz. the presence of more or less inflammation. It could only commence on the living body. Lastly, Orfila ascertained, that when these poisons were introduced into the alimentary canal, twenty-four hours after death, they no longer excited redness or inflammation, because life is entirely destroyed in the capillary vessels. It is only when they are applied an hour or two after death, that the inflammatory phænomena, accompanied *with the line of demarcation* are capable of occurring.*

As to slow poisons, in the sense already applied to that name, we may remark, that their peculiarities are very difficult to be distinguished. Foderè enumerates a long list of appearances, such as obstruction of the lymphatics, emptiness of the blood vessels, a contraction and shrivelling of the viscera and marasmus,† but later and more minute observers contradict these.‡

Prince Charles of Augustenberg, Crown Prince of Sweden, and the predecessor of Bernadotte in that station, fell dead from his horse on the 22d of May, 1810, while reviewing troops in Scania. His death, during that stormy period of public affairs, excited great attention, and an opinion soon spread abroad that he had been poisoned. The king ordered a judicial investigation, and it appeared that Dr. Rossi, the physician of the late prince, had, without any directions, proceeded to inspect the body twenty-four hours after death; that he had performed this operation with great negligence, omitting many things

* Orfila, vol. 2, p. 535 to 547. Foderè, vol. 4, p. 285.
† Foderè, vol. 4, p. 268. ‡ Orfila, vol. 1, p. 477.

which the law prescribed, which the assisting physicians proposed, and which were essential to render it satisfactory ; and finally, that the coats of the stomach, instead of being preserved and submitted to chemical analysis, were, according to his own acknowledgment, thrown away. The royal tribunal adjudged him to be deprived of his appointment, and to be banished from the kingdom. This decision would not of course diminish the suspicion already excited ; and among other physicians who were consulted on the case, M. Lodin, professor of medicine, at Lynkoping, presented two memoirs, in which he stated it as his opinion, that a *slow poison* of a vegetable nature, and probably analogous to the *aqua tofana*, had been administered to the prince, and that this had caused the apoplectic fit. His reasons were, 1. that the prince had always enjoyed good health previous to his arrival in Sweden, and indeed had not been ill, until after eating a cold pye at an inn in Illaby. He was shortly after seized with violent vomiting, while the rest of the company experienced no ill effects. 2. The prince was naturally very temperate. 3. Ever since his arrival in Sweden, he had experienced a loss of appetite, with colic and diarrhea ; and 4. That on dissection, the spleen was found of a black colour, and in a state of decomposition, and the liver indurated and dark coloured, whilst during life, he had experienced no symptoms corresponding to these appearances. Dr. Lodin confessed, however, that he was unacquainted with the effects that indicate the administration of such a slow poison, but thought that the previous symptoms were such as might be expected from it.

For the credit of the profession, this conjectural opinion met with decided reprobation from other medical men. It appeared that the prince had for several days previous been subject to giddiness and pain in the head, and that all the symptoms were readily referable to a simple case of apoplexy, while the appearances on dissection, shewed that rapid tendency

to putrefaction, which is frequently observed in similar cases.*

In the conclusion of the last section, several diseases were mentioned, that might be mistaken for the effects of poison. I shall now indicate certain circumstances which may lead to error, when examining the dead body—And they are cases of sudden death and peculiar phœnomena observed on dissection.

It is not necessary to enlarge on the affections which in numerous cases destroy an individual suddenly. Dissection generally developes the rupture of some large vessel, the effusion of blood on the brain, or some similar disease, as the immediate cause, and these instances cannot be mistaken by a skilful anatomist, although the vulgar may be suspicious. So also when death follows, as is sometimes the case, from the indulgence of passion. Here the viscera are generally in a natural state, and of course, as all lesion is absent, it will be impossible to infer that a noxious substance has been taken.

But there are diseases whose course and termination resemble in some degree the effects of poisons, and the symptoms that accompany them, with the traces that they leave, may often lead into error. The complaints that present the most striking appearances of this kind, are probably a repelled eruption, gout when it has left the extremities and attacked the stomach, acidity of the bile, malignant fevers and worms.† Many of these are accompanied with severe pain and violent vomiting, which commences so suddenly, as almost to bear the semblance of a disease from poison. Cholera morbus is another, which during life, is marked by violent symptoms, and on dissection, presents marks of inflammation or gangrene. The history of the case, however, the season of the year, the peculiar and appropriate symptoms and appearances on dissection, all must be

* Foderè, vol. 3, p. 20; vol. 4, p. 236. Edin. Ann. Register, vol. 3, p. 345.
† Mahon, vol. 2, p. 312.

critically scrutinized in order to arrive at a just conclusion.*

As to the peculiar phœnomena observed on dissection, the following cases may first be stated. In an instance where the stomach was found covered with exanthemata, the physicians would have pronounced judgment concerning the cause of death, had they not been informed, that this eruption originated from the person having had the measles, and which, on account of the weakness of the patient, were only commencing to be thrown out on the skin, when he died.† Belloc gives us the following instructive case. An individual of the age of seventy, although otherwise in apparent good health, was subject to repeated attacks of gout. One evening about nine o'clock, he visited a particular friend, and at his house, took some food, and at twelve returned home in high spirits. He went to bed, and at two in the morning, rang for his servant, who found him speechless and apoplectic. Medical aid was called, but before it arrived, he was dead. On dissection no alteration from the natural state was observed in the body, except that about eight inches of the ileon was livid and apparently approaching to gangrene. It had been formerly noticed, that the deceased complained of pain in that part. And as the stomach and other intestines were in a healthy state, it was determined, that no noxious substance could have caused this termination, but that it was owing to a translation of the gouty matter.‡ But the difficulty might have been

* In cholera morbus, for example, the bilious vomitings and stools, with their attendant symptoms, will serve to characterise it, while on dissection, although the stomach and liver are sometimes found inflamed, yet Orfila remarks, *that the inflammation or gangrene never extends throughout the whole of the digestive canal.* (Orfila, vol. 2, p. 495.) This observation appears to me strongly verified in a paper that has lately appeared in the Edin. Med. and Surg. Jour. vol. 19, p. 8 and 9. The author, Dr. Ranken, in treating of the epidemic cholera of the East Indies, runs a parallel between the symptoms and appearances on dissection, observed in this dreadfully rapid and fatal disease, and those resulting from poisons. The similarity is certainly great in many particulars, yet the one just adverted to, does not appear to have been witnessed in any examination, although the disease is infinitely more violent than it appears in our own climate.

† Morgagni, vol. 2, epist. 69, p. 398.

‡ Belloc, p. 149.

greatly increased, as Foderè remarks, if instead a metastasis to the ileon, there had been one to the stomach. These instances then, prove the great importance of knowing the previous habits of the patient, his maladies and their effects on his system.

But there are intrinsic difficulties connected with the appearance of the stomach, which have rendered it a subject of great doubt, and almost forced medical jurists to avoid drawing any inferences from it. I shall endeavour to state these as succinctly as possible.

1. *The vascularity of the human stomach after death* may lead to error unless properly observed. I have already mentioned a remark of Baillou on this point, and we are further indebted to Dr. Yelloly for some instructive observations on it. This distinguished physician examined the stomachs of twenty individuals, among which number, were five criminals, who were hanged and in whom therefore the appearances of health were likely to be found. Not one of the whole number had any affection of the stomach while living. In all he observed a highly vascular state of the villous coat of the stomach, in particular parts, (as about the pylorus and cardia,) with but two exceptions ; in one of these, no vascularity was observed, and in the other it was obscure. In the five executed criminals, the vascularity amounted to a red or crimson hue. These appearances were distinct for a short time only after death, being most marked on the first day, and soon after, but at irregular periods, becoming more obscure. Dr. Yelloly infers, from these dissections, " that in the villous coat of the stomach, appearances of vascular fulness, whether florid or dark coloured, in distinct vessels, or in extravasations of different sizes, are not to be regarded as unequivocal marks of disease. They occur in every variety of degree and character, under every circumstance of previous indisposition, and in situations where the most healthy aspect of an organ might be fairly inferred. They are found in every

part of the stomach, but principally in the posterior part of the great end, and in the lesser curvature, and they cover spaces of various extent, but are generally well defined and terminate abruptly." He also supposes that this vascularity is confined to the adult stomach, and is but seldom seen in young subjects.*

If we compare this statement, with the appearances mentioned by Dr. Baillie, we shall readily see the danger of falling into mistakes on this point. Ordinary inflammation he characterises thus. "The stomach, upon the outside at the inflamed part, shows a greater number of smaller vessels than usual, but frequently not much crowded. In opening into the stomach, it is found to be a little thicker at the inflamed part, the inner membrane is very red from the number of small florid vessels, and there are frequently spots of extravasated blood."

But, "when arsenic has been swallowed, the stomach is affected with a most intense degree of inflammation. Its substance becomes thicker, and in opening into its cavity, there is a very great degree of redness in the inner membrane, arising partly from the very great number of minute vessels and partly from extravasated blood. Portions of the inner membrane are sometimes destroyed, from the violent action that has taken place in consequence of the immediate application of the poison. I have also seen a thin layer of coagulable lymph thrown out upon a portion of the inner surface of the stomach. Most commonly too, some portion of the arsenic is to be seen in the form of a white powder, lying upon different portions of the inner membrane."†

If we separate the ordinary, from the occasional appearances here described, we shall find, that the statements of Dr. Yelloly and Dr. Baillie in some measure correspond. The former has however sug-

* See Dr. Yelloly's paper "on the vascular appearance in the human stomach, *which is frequently mistaken for inflammation of that organ*," in the Medico-Chirurg. Transactions, vol. 4, p. 371. See also Edin. Med. and Surg. Journal, vol. 10, p. 236.

† Baillie, Amer. ed. p. 67, 68

gested, that when coagulable lymph is thrown out in the substance, or on the surface of the villous coat, it is to be deemed an unequivocal indication of previous inflammation. But this is a rare occurrence in dissections, and it may be also, that thick mucus will sometimes assume the appearance of coagulable lymph.* Certainly there is a danger of confounding the ordinary vascularity of the stomach, with the indications of *slight* inflammation, *and such indeed as we may expect to find in many cases of poisoning.*

2. *Digestion of the stomach after death.* This subject was first developed by the illustrious John Hunter, and since his days, it has been illustrated by his pupils. That anatomist found repeatedly on dissection, that the great end of the stomach was digested, and holes made in it. "To be sensible of this effect," says he, "nothing more is necessary, than to compare the inner surface of the great end of the stomach with any other part of the inner surface—what is sound will appear soft, spongy and granulated, and without distinct blood-vessels, opaque and thick; while the other will appear thin, smooth, and more transparent, and the vessels will be seen ramifying in its substance, and upon squeezing the blood which they contain, from the larger branches into the smaller, it will be found to pass out at the digested ends of the vessels, and appear like drops on the inner surface." Again, he observes, "that when the stomach is actually perforated, the edges of this opening appear to be half dissolved, very much like to that kind of dissolution which fleshy parts undergo when half dissolved in a living stomach, or when dissolved by a caustic alkali, viz. pulpy, tender, and ragged." Lastly, he remarks, that he found these appearances more frequent in those who had died a violent death. He relates two cases of this kind, in which the persons had died shortly after having their skulls fractured, and a third one where a man had been hung.

* Velloly, ut supra.

The cause of this appearance of the stomach, is supposed by Mr. Hunter to be the action of the gastric juice on the coats of the stomach. And the reason why this effect is not produced during life, is, according to him, the constant resistance of the vital principle to its action. He also observes, that the power of the gastric juice is not confined to the stomach alone, since he has often noticed, that after it had dissolved the stomach in its usual place, the contents of the stomach would come in contact with the spleen and diaphragm, and partly dissolve the adjacent side of the spleen and diaphragm, so that the contents of the stomach were found in the cavity of the thorax, and had even affected the lungs in a small degree.*

Dr. Baillie's description of this phœnomenon is as follows: "In looking upon the coats of the stomach at its great end, a small portion of them frequently appears to be thinner, more transparent, and feels somewhat more pulpy than is usual; but these appearances are seldom very strongly marked. They arise from the action of the gastric juice resting on that part of the stomach in greater quantity than any where else, and dissolving a small portion of its coats. This is, therefore, not to be considered as a consequence of a disease, but as a natural effect arising from the action of the gastric juice, and the state of the stomach after death. When the gastric juice has been in considerable quantity, and of an active nature, the stomach has been dissolved quite through its substance at the great end, and its contents have been effused into the general cavity of the abdomen. In such cases, the neighbouring viscera are also partially dissolved. The instances, however, of so powerful a solution, are rare, and have almost only occurred in persons who, while in good health, had died suddenly from accident."†

Such is the explanation given of this appearance by

* Hunter, in Phil. Trans. vol. 62.
† Baillie's Morbid Anatomy, Amer. ed. p. 75.

the best anatomists both in England and France.* But there are certain qualifications urged to various parts of the above statements, which it is proper to mention.

In the first place, it is denied that the erosion of the stomach only occurs in those who have died suddenly from accident. Mr. Allan Burns mentions, that he had seen nine cases in which this solution had taken place, three of which were persons worn out by debilitating diseases, and in an emaciated and anasarcous state.† Dr. Haviland has also lately related a case of a young man who died of fever, but had previously enjoyed good health. The body was opened twelve hours after death, and the mucous membrane was found red and vascular, and spots of extravasated blood were seen below that coat. There were two holes in the stomach, the larger very near to the cardiac end of the small curvature, and on the posterior surface. Its size was more than an inch in length, and about half that breadth. The other was not far from the former, and also on the posterior surface, about the size of a sixpence. The edges of these holes were smooth, well defined, and slightly elevated. The coats of the stomach were thin in many spots, and in one in particular, nothing was left but the peritoneum—the mucous and muscular coats being entirely destroyed. Lastly, the diaphragm was perforated in its muscular portion with a hole large enough to admit the end of the finger.‡ Several other instances are recorded by various writers, where perforation was observed in patients who had died after an illness of greater or less duration.‖

* Grimaud, professor at Montpelier, has confirmed the observations of Mr. Hunter in his dissections. Foderè, vol 4, p. 307.

† *Observations on digestion of the stomach after death,* in Edin. Med. and Surg. Journal, vol. 6, p. 132, 133.

‡ Dr. Haviland, in Trans. Cambridge, Phil. Soc. vol. 1. Annals of Philosophy, N. S. vol. 4, p. 292.

‖ See the London Med. Repository, vol. 4, p. 112 ; vol. 10, p. 416 ; vol. 19, p. 208. The Eclectic Repertory, vol. 5, p. 495, case by Mr. Want. New-York Med. Repository, vol. 18, p. 287, case by Dr. Pascalis. American Med. Recorder, vol. 4, p. 151, case by Dr. Cheeseman. Quarterly

Again, it is urged by Mr. Burns, that the digestion is not confined to the great end, as stated by Mr.

Journ. Foreign Med. and Surg. vol. 2, p. 328, case of M. Segelas, in an infant eight months old. Her disease was diarrhœa and vomiting, and she had suffered under the former forty-five days, and under the latter twenty days previous to death. The perforation was not accompanied with any trace of inflammation. See also the same Journal, vol. 5, p. 297, for another case, by Dr. Peters, in a female aged 52. I have also been favoured with the outlines of a case, which occurred in the practice of my brother, Dr. J.B. Beck. The patient laboured under hydrothorax, but had never complained of pain in the region of the stomach. She had never suffered with vomiting, and her appetite had been good, until within a few weeks of her death. On dissection, five ulcers were found in the stomach, one of which perforated through the different coats. A more minute statement of this case will appear in the New-York Med. and Phys. Journ. It appears that Chaussier has examined this subject, and given some general views concerning it, which are worthy of attention. "The causes, (according to him) which produce erosions and perforations of the stomach, are of two kinds; first, the destruction of a schirrous tumour, the progress of a cancerous ulcer; second, a morbid action of erosion, of ulceration which has commenced spontaneously at some point of the mucous lining of the stomach. The perforations of the first kind are not rare, but cannot easily be confounded with those which are the result of a caustic poison. Those of the second kind may be divided into acute and chronic; the first sometimes occurring in a very short space of time. The following are the characters given by M. Chaussier: "The ulcerations vary in size, shape, and place; they occur particularly at the basis of the stomach, and the parts corresponding to the spleen and diaphragm. The contents of the organ are then sometimes effused into the abdomen or the thorax if the diaphragm be perforated, but most commonly there is no effusion, from the adhesion of the parts to those in the vicinity. If the adhesions be broken, a viscous, unctuous liquor, not fœtid, flows out; it has sometimes the odour of musk, is always brownish, and mixed with blackish flocculi, as though fine charcoal were added to a mucous serum. The edges are soft, fringed sometimes with a blackish line more or less marked. Elsewhere the stomach retains its ordinary shape and consistence; it presents no appearance of thickening or inflammation; the capillaries of its mucous membrane appear, however, more developed, particularly in the vicinity of the perforation; this last sometimes forms in a few hours in people in health; most frequently after some days illness, and when no cause of external violence or poisoning can be suspected." When the perforation is the result of a caustic, irritating poison, its edges are of the same thickness as the organ; sometimes they are hard and callous; in the spontaneous perforation the edges are thin, and formed only by the peritoneal membrane, the two other coats of the stomach being more extensively destroyed than the serous one. In this case too, the opening is not so irregular as in that which results from the action of a corrosive substance. The circumference of perforations caused by nitric acid is yellow, from the chemical action of this substance. In the case of strong sulphuric acid it is black. *Almost always when the perforation is the effect of poison, the parts not perforated are more or less inflamed*, while traces of the same affection are found in the mouth, the pharynx, and the intestinal canal; on the other hand, *for the most part in the case of spontaneous perforation, the unperforated parts present no appearance of inflammation.* This last character is not, however, constant; for, as on the one hand, perforations from poison are sometimes, though rarely, unattended by inflammation of the unperforated parts of the intestinal canal, so on the other, spontaneous perforations may be observed in which there is inflammation of the stomach and intestines." Quarterly Journal of Foreign Med. and Surg. vol. 3, p. 258, 259.

Hunter and Dr. Baillie. In several instances, he found the *forepart* of the stomach perforated about an inch distant from the pylorus, and midway between the smaller and greater curvatures. As it is a fair inference from the statement of Mr. Hunter, that the coats of the stomach will only be acted on at that part on which the contents have rested, he conceives that these cases affect its general truth, and suggests in explanation, that the action may be owing to the gastric juice retained in the vessels which had secreted it.*

Lastly, Dr. Yelloly has suggested an objection, which appears in some degree to affect the doctrine itself. He observes, that in these cases of *partial* digestion, if an erosion had actually taken place, the minute extremities of the vessels must have been included in the destruction, and on injecting the arteries, an extravasation would necessarily be observed, but in many trials, particularly where the stomach was very thin, no such extravasation occurred.† Mr. Burns found, however, that the vessels were unable to resist the force of the syringe in injecting the body, and the cavity of the stomach was filled with wax.

The application of this subject in legal medicine, is the distinction between it and erosion from the effects of poison. How important this becomes, will be hereafter shown, when relating the case of Miss Burns. But I cannot conclude this section without suggesting, that until this subject is more profoundly

* Burns ut antea. In one case, he found the stomach eroded, and demonstrated this to his class. He then stitched up the abdomen, and laid the body aside in a cold situation for two days. On again opening it, he found that the liver, where it lay over the dissolved part of the stomach, was pulpy ; its peritoneal coat was dissolved, and its substance was tender to a considerable depth. At the same time, the other parts of the liver were as solid as before, and every other part was free from putrefaction.

† Edin. Med. and Surg. Journal, vol. 10, p. 237. As to digestion of the stomach *being rare or common*, Dr. Yelloly is of the former opinion. Dr. Joseph Adams in reply, suggested that all his subjects were examined within a very short time after apparent death, and that the parts might have retained life sufficient to prevent the action of the gastric juice. (Lond. Med. and Phys. Journ. vol. 31, p. 178.) In the same volume, (page 3) is a narrative by Mr. Borret, of a man in high health, aged 64, who was hung, and his stomach examined 44 hours after death. It was found uninjured.

investigated and better understood, *erosion distinct from inflammation* should not be regarded as a positive proof of poison.

3. *Rupture of the stomach.* We are indebted to Dr. Crampton and Mr. Travers for some instructive cases of this dreadful disease. The patients in the midst of health, are seized with the most acute and unremitting pain in the stomach, and a rigidness and contraction of the abdominal muscles, and death ensues after a few hours illness. On dissection, the contents of the stomach are found in the cavity of the abdomen, and a perforation is discovered, resulting from an ulcer of the mucous coat.*

It will immediately occur to the reader, that a termination so sudden and fatal may lead to suspicion, and the appearances exhibited on dissection would in some degree strengthen this, were it not understood, that death has and may occur from the natural cause in question, without the intervention of any poisonous substance.

I have now concluded what may be considered as general and introductory remarks to the subject of poisons. The symptoms and the appearances on dissection have been arranged in various classes, not because the system used for this purpose was deemed perfect, but that it seemed to be an approach to the truth, and at all events was preferable to the long catalogues of ancient writers, in which the symptoms and lesions not only of every class, but of every individual poison, were arranged indiscriminately. On approaching the consideration of individual poisons, I propose to notice their effects only as I find them warranted by the history of particular cases, and I shall endeavour to bear in mind the following remarks as a guide and a caution. "Systematic writers upon poisons have jumbled together the symptoms of va-

* Medico-Chirurg. Trans. vol. 8, p. 228. The case related in the London Med. Repository, vol. 5, p. 157, as occurring to Dr. Gastallier of Paris, seems to have been of a similar nature.

rious doses operating under different circumstances, without discriminating the constant effects, if there be any, from the common or usual effects; nay, they have drawn their descriptions of the effects of poisons not only from different poisons of the same class, but even from poisons of different classes, and from their effects upon animals of different classes. Poisons must still be studied in the way of induction. We must collect all the special facts and observations—we must compare and generalize them, and proceed no farther in our general inferences than these facts warrant."*

* Edin. Med. and Surg. Journ. vol. 7, p. 86.

CHAPTER IV.

MINERAL POISONS.

Arsenic. *White oxide of arsenic.* Modes in which it may prove poisonous. Internally. (*a*) Its exhibition by the mouth. Symptoms. Classification of these—when the patient survives the effects—when he lives beyond a day or two—when he dies within a few hours. (*b*) By injection into the rectum or vagina. Externally. (*a*) Applied to a wound or ulcer, or even to the skin. Effects of this. Cancer plasters. (*b*) By inhaling its vapours. Appearances on dissection, in those who survive several days—in those who die in a few hours. Whether putrefaction follows rapidly after death in these cases. Effects of arsenic on animals. Jaeger's experiments—Brodie's experiments. Chemical proofs. 1. Tests or re-agents. (*a*) Lime-water. (*b*) Ammoniaret of copper. (*c*) Sulphate of copper. (*d*) Sulphuretted hydrogen. (*e*) Nitrate of silver. (*f*) Iodine. (*g*) Nitrate of potash. (*h*) Chromate of potash. 2. Reduction of the metal. (*a*) Its reduction with the black flux. (*b*) The garlic smell. (*c*) The tombac alloy. (*d*) Its reduction by the galvanic pile. Difficulties that may occur when the poison is mixed with animal or vegetable substances. Modes of removing these—effect of tests on various mixtures of arsenic with aliments and drinks. Inquiry into the degree of proof necessary to determine that arsenic has been administered—whether its reduction to the metallic state should be deemed indispensable—objections to this. Medico-legal cases—Miss Blandy—Nairn and Ogilvie—Miss Burns—Kesler. Antidotes—propriety of laws prohibiting the unrestricted sale of arsenic. *Arsenites. Arsenic acid. Sulphurets of arsenic. Black oxide of arsenic. Arsenical hydrogen. Metallic arsenic.* Mercury. *Corrosive sublimate.* Modes of exhibition. Internally. (*a*) Its exhibition by the mouth. Symptoms. (*b*) By injection. Case of Sir Thomas Overbury. Externally, applied to a wound or ulcer, or to the skin. Appearances on dissection. Effects on animals. Chemical proofs. Operation of various animal and vegetable substances on corrosive sublimate —Effect of tests on these mixtures. Antidotes. *Red precipitate and red oxyd.* Other mercurial preparations. *Mercurial vapours, and mercury in a state of extreme division.* Injurious effects of these.

The MINERAL POISONS are most frequently used as the instruments of suicide or of homicide, and they

hence deserve the earliest and most minute attention.* I shall consider them in the following order:

Arsenic	Iodine
Mercury	Acids
Antimony	Alkalies and their carbonates
Copper	
Zinc	Barytes and its salts
Tin	Quicklime
Silver	Hydrogenated sulphuret of potash
Gold	
Platina	Nitrate of potash
Bismuth	Muriate of ammonia
Sulphate of iron	The gases
Lead	Glass and enamel
Phosphorus	

ARSENIC.

ARSENIOUS ACID, OR WHITE OXIDE OF ARSENIC.

The substance commonly known under the name of arsenic, is according to chemical nomenclature, *arsenious acid*, or *the white oxide of arsenic;* and it has received these apparently incompatible names from the fact, that though more analogous to the oxides, yet it possesses some of the properties of acids. It is an artificial production, and is prepared principally in Saxony, from cobalt ores Whilst the latter, in the crude state, are roasting for the purpose of obtaining zaffre, the vapours arising from the oxide are condensed in a long and large chamber, and to these potash is added. The mixture is then sublimed, and the white oxide is obtained, leaving potash with sulphur. This employment is a dangerous, and in a short time, fatal one; and accordingly, convicts whose punishment would otherwise be death, are condemned to it.†

* In noticing poisons, I shall omit as much of their chemical and botanical history as is practicable, consistently with the design of this work. The reader will be considered as generally acquainted with this preliminary information.

† Gordon's Inaug. Dissertation, p. 4. See a notice of this production in

Arsenious acid occurs in commerce in the form of shining semi-vitreous lumps, and when reduced to powder, bears some resemblance to white sugar. Its taste is generally said to be acrid and corrosive, leaving an impression of sweetness.*

It may be poisonous either internally or externally exhibited. 1. *Internally*, by the mouth passing into the stomach, or by being injected into the vagina or rectum. 2. *Externally*, by being applied to a wound or ulcer, or by inhaling its vapours.

INTERNALLY, *(a)* Its exhibition by the mouth.

Hahnemann, who has written on this poison, proposes a classification of its effects into three degrees. When death follows the exhibition of the poison within twenty-four hours, it constitutes the first degree; and when later than twenty-four hours, the second degree; and when the case, though attended with dangerous symptoms, does not terminate fatally, it belongs to the third class.†

This arrangement is evidently useful, since it may lead to proper indications for the application of curative means; and it is important, as it must tend to increase our knowledge of the complicated symptoms arising from the exhibition of the poison.

A writer in the Edinburgh Medical and Surgical Journal, has presented us with a description of its effects according to the above arrangement, drawn from a careful comparison of all the cases which have occurred in the course of his reading. I shall copy this, and add such remarks and references as may appear to deserve notice.‡

the Edinburgh Med. and Surg. Journal, vol. 11, p. 134. The dangerous nature of the vapours arising from the roasting of cobalt ores, appears to have been early known. They were considered so hurtful to the miners, that a prayer was formerly offered up in the German church, that God would preserve miners from cobalt and spirits. Beckmann, vol. 2, p. 263.

* Dr. Gordon doubts this statement, and observes, that when *first* tasted, it is always sweet like sugar, but afterwards somewhat acid. Page 9.

† Edinburgh Med. and Surg. Journal, vol. 7, p. 86. This will be as proper a place as any to mention, that the *smallest* quantity of arsenic may prove injurious, and it is said that *two* grains have caused death.

‡ The plan I shall pursue, will be, first, to quote the description from the authority already named, and then to add such peculiarities as may have been noticed in the cases that I have examined.

"In the slightest case in which the operation of arsenic is recorded as producing poisonous effects, the symptoms are uneasiness at the præcordia, and a sense of heat there." This effect is often perceived in those who take it medicinally. "When the dose of poison is somewhat greater, but not sufficient to produce death, violent vomiting is commonly the first symptom, although in some instances it is preceded by a sense of heat in the tongue and throat; in other cases, these sensations are expressly mentioned as not felt during the whole course of the disease. In these cases, when the vomiting is instant, and the poison has been taken on a full stomach, the patient seems to owe his escape to the poison being discharged before it has time to act. The next symptom which claims our attention, is the purging, sometimes of blood; but purging occurs less frequently in this slight degree of poisoning, than in the more severe cases. In the region of the stomach and bowels, pain is frequently felt, but it is often rather an unsupportable uneasiness and oppression, than pain properly so called. The stomach is not described as swelling; and in one case, where there was hiccup, eructation, and difficulty of breathing, it is expressly mentioned that it was not tense or swelled.

A sensation of coldness, especially in the extremities, and cold sweat, seems to have been almost always present, with general paleness, and paleness of the countenance, and in some cases, languor, faintishness and a tendency to sleep. In this degree of poisoning, convulsions are not frequently observed, and the thirst and fever seem to arise from some irritation in particular persons, as they are seldom expressed. In one case only, is *ardor urinæ expressed.*"*

* The cases which I have examined with reference to this division, and for the purpose of verifying or correcting the symptoms given in the text, are related by the following persons:—*Mr. Murray* of Alford, three cases in the Edinburgh Med. and Surg. Journal, vol. 18, p. 167. *Mr. M'Leod*, three cases in the Edinburgh Med. and Surg. Journal, vol. 15, p. 553. *Mr. Davies*, two children, London Med. and Phys. Journal, vol. 28, p. 345. *Mr. Bucknill*, in Ibid. vol. 29, p. 44. *Dr. Roget*, in the Medico-Chirurg. Trans-

There are some peculiarities which occasionally occur that also deserve notice. *Epileptic fits* were present in Dr. Roget's case, noticed below, and Dr. Gordon states, that Dr. Duncan, Jun. in his lectures quotes several authors, and in particular, Alberti and Forestus, who have noticed this as a symptom.*

Paralysis has been repeatedly observed by Dr. Falconer, once in the hand, like lead, but in two other cases, it was general. It began with numbness of the extremities, but there was no wasting.†

"In the second degree of poisoning, from arsenic, where the patient lives above a day or two, the first complaints are heat and thirst, or vomiting, or inexpressible distress; the first is less frequently observed than the other two. Purging is not mentioned in any of the cases of this sort, but in one a fœtid stool was procured by a pessary, and in one, gripes are noticed; in two, the belly swelled; in one, there was

actious, vol. 2. *Dr. Vandendale*, (Orfila, vol. 1, p. 143.) *Mr. Marshall*, five cases—the Turner family, supposed to have been poisoned by Eliza Fenning. *Mr. Shipman*, in the London Med.Repos. vol. 9, p. 455. *De Haen*, Ratio Medendi, vol. 3, p. 113. *Dr. Barnum*, in New-York Med. Repository. vol. 5, p. 43.

These cases verify the statement in the text in most of its leading particulars. In those of Murray, M'Leod and Bucknill, the burning heat in the throat is expressly mentioned. Purging generally occurred, and in some instances, it was bloody. In Bucknill's case, the discharge was so acrimonious as to excoriate the anus. In two individuals, there was tenesmus and constipation. In one case the urine was voided with difficulty. Numbness of the extremities, loss of power in them, general debility and faintness, are noticed in almost all. One of Murray's patients had soreness of the eyes; and in Davies' case of a child of nine years, a vesicular eruption commenced around the mouth and circumference of the eyes, which in a day or two formed a scab, and gradually fell off. In M'Leod's case, there were convulsive spasms, loss of the powers of speech and swallowing, and apoplectic appearances; but I suggest whether the administration of the sulphuret of potash might not have aided in producing these. These patients also, at an early period of their illness, had purple petechiæ on the chest and neck. In De Haen's case, cramps of the feet, with pruritus and partial paralysis, were present. In Vandendale's, meteorismus abdominis, with loss of the hair and *nails of the hands and feet*. Mr. Shipman's case assumed the form of a marked case of enteritis.

* Gordon, p. 18.

† Mem. Med. Soc. of London, vol. 2, p, 224. In a case seen by Mr. Bedingfield, paralysis of the extremities was produced. London Med. Repository, vol. 6, p. 227. And in another by Dr. Hosack, a palsy of the muscles of the neck and right arm, was occasioned by the application of this poison to an encysted tumour. American Med. and Phil. Register, vol. 3, p. 389.

great feebleness and lassitude, and in all, convulsions seemed to have taken place—in one case impeding deglutition."

There is a very interesting case belonging to this division, related by Mr. Murray. The patient survived seven days. The course of the symptoms was as follows—heat, thirst, pain in the region of the stomach, vomiting, which frequently recurred after drinking, occasional ineffectual attempts to go to stool. The pulse was frequent, one hundred to one hundred and ten, and not strong. Hoarseness, soreness of the eyes and shifting pains in the extremities. He voided his urine frequently. This illness did not confine him to bed, and indeed he rode several miles in order to consult Mr. Murray, while under its effects. The day before his death, the hoarseness increased, with a more anxious expression of countenance. He was found dead in bed.*

"In the third degree of poisoning, where death takes place within a few hours, the symptoms succeed each other rapidly, or begin at the same time, and the fainting and general debility, almost always precede the vomiting. The vomiting occurred in all the cases but two; purging or gripes in most of the cases; the matter passed by stool is in one case described as green, watery and viscid. In one case, there was vertigo, also general pains and loss of speech. Convulsions did not occur often, but there was sometimes hiccup. In a few cases there was much heat and thirst; even in one, in which (a symptom more frequent than heat) there were complaints of a sensation of intense cold, and paralysis of the extremities with cold sweat. The pulse in the only case in which it is mentioned, was slow and languid; and death seems to have generally proceeded from exhaustion and rapid sinking of the vital powers. In

* Edinburgh Med. and Surg. Journal, vol. 18, p. 167. The dissection of this patient will be mentioned hereafter. The case of Mr Blandy also belongs to this division, but as I intend to notice it at length, I will not repeat the symptoms in this place.

none of these violent cases, is there any mention of delirium, or affection of the mind, except in one, in which the poison was applied externally to the head."

Some peculiarities in particular cases, must be added to these, and one which deserves repetition, is the circumstance that patients sometimes *do not vomit.* Wepfer mentions an instance of this kind. Chaussier relates of a man who swallowed arsenic in large pieces, and in whom the only symptoms were slight syncope on the approach of death. On dissection the arsenic was seen almost in the same state in which he had swallowed it, and it was not possible to discover the least appearance of erosion or inflammation. There are several other cases recorded, where the patients denied that they felt any *pain.** And one of the most remarkable is the instance of a boy eight years old, who swallowed a small quantity of a substance picked up in the streets, which contained arsenic. He lived twenty-one hours, and experienced no pain even on pressure, yet on dissection, the stomach was found in a gangrenous state near the pylorus.†

It may appear an omission, were I not to state the symptoms generally, as enumerated by systematic writers; and I therefore copy the list given by Orfila,

* The following cases are instructive, and present some interesting peculiarities. They are related by the following observers:—*Dr. Tonnelier.* in Orfila, vol. 1, p. 118. *Dr. Laborde,* in Orfila, vol. 1, p. 120. *Dr. Yelloly,* Edin. Med. and Surg. Journal, vol. 5, p. 389. *Mr. Davies,* a child five years old, London Med. and Phys. Journal, vol. 28, p. 345. *Mr. Pettigrew,* London Med. Repository, vol. 11, p. 525. *Mr. Soden,* (from London Medical Review,) Eclectic Repertory, vol. 2, p. 325. *John Hunter,* from Trans. of a Society, &c. Eclectic Repertory, vol. 1, p. 433. *Chaussier,* Edin. Med. and Surg. Journal, vol. 7, p. 92. *Morgagni,* vol. 2, p. 366.

In the cases of Yelloly and Laborde, both patients denied that they felt any pain. The pulse in Yelloly's was slow and languid; in Laborde's, tranquil; in Tonnelier's, Hunter's, Pettigrew's, and Soden's, small, tremulous and frequent. A comatose state preceded death in a few; but generally, the sensorial functions were not disturbed. In the astonishing case related by Metzger, (Schlegel, vol. 4, p. 22,) where he removed one ounce and thirty-five grains from the stomach after death, and considers that only equal to *one third* of what was actually present, the patient laboured under most violent pain, vomiting and diarrhœa, yet "*per totum hoc tempus animo constans, deque instante morte persuassimus.*" He died convulsed. Stercoraceous vomiting is said by Dr. Gordon (p. 12) to have occurred, but I can find no case in which it is mentioned.

† London Med. Repository, vol. 2, p. 270.

although the reader cannot fail, I believe, to remark, that it is far from being as useful, as when it is subdivided in the manner adopted in the previous pages.

"An austere taste, fetid mouth, frequent ptyalism, continual spitting, constriction of the pharynx and œsophagus, the teeth set on edge, hiccup, nausea, vomiting of a matter sometimes brown, sometimes bloody; anxiety, frequent faintings; heat of the præcordia; inflammation of the lips, tongue, palate, throat, and œsophagus; the stomach painful to such a degree as not to support the most emollient drink; the alvine discharges black, and of a horrible fœtor; the pulse small, frequent, concentrated and irregular —sometimes slow and unequal; palpitation of the heart, syncope, unquenchable thirst, pungent heat all over the body—sensation as of a devouring fire—sometimes an icy coldness; breathing difficult; cold sweats; urine scanty, red and bloody; change of the features of the countenance—a livid circle round the eyelids; swelling and itching over the whole body, which is covered with livid spots, and sometimes with a miliary eruption; prostration of strength—loss of feeling, particularly in the feet and hands; delirium —convulsions, often accompanied with an insupportable priapism—falling off of the hair—detachment of the epidermis; and lastly, death."

It is rare (he adds) to see all these symptoms united in the same person; sometimes almost all of them are wanting.*

(b) By injection into the rectum or vagina. This is fatal in the same way as already described, but the inflammation affects the intestines more than the stomach. A horrible history is related of two women, "quibus per vaginam oxidum arsenici marito admotum est. Occubuere ambæ, harum una inopinato, et perdurante horrore, frigore, et urente vaginæ dolore correpta est, et post vomitus fere continuos, et deliria, elapsis 28 horis ab applicatione veneni, mortua est. Sectio monstravit abdomen non tumidum, nullas in

* Orfila, vol. 1, p. 125.

cute maculas; labia vulvæ magna paulum tumida et rubra; in vagina, patula flaccida, pauca grana arsenici crystallini; os uteri sphacelatum et apertum; corpus ejus naturale; ventriculum fere sanum, duodenum inflammatum, multaque bile perfusum; pulmones lividos, fere nigros; in utroque cordis ventriculi polypos; reliqua viscera sana, sanguinem in omnibus vasis fluidum et solutum."*

In one experiment on a dog, forty-eight grains of arsenious acid, in the form of powder and fragments, were introduced into the rectum. He shortly after passed the whole of it by stool. Two days after, the same quantity, but pulverized, was introduced. This produced loss of appetite and dejection, and he died in eight days. The parts round the anus were excoriated, and the integuments detached, so that there was an ulcer of some extent. The mucous membrane of the intestines near the anus, was of a greenish grey, and above it of a bright red, for the space of six or seven inches—but in ascending upwards, it gradually diminished in intensity.†

* Gordon's Dissertation, quoted from the Comment. de Rebus. Lipsiæ, 1793, tom. 35. Metzger probably mentions the same case, p. 390; and I am in doubt whether the above is also not the same that is said to have happened in Denmark. See London Med. Repository, vol. 9, p. 246. If not, we have several instances of this most atrocious crime; for in the work last quoted, is another stated, of a female in the *Department de l'Ourthe* in France, aged forty, who died after a short illness, which was manifested by a considerable tumefaction of the genitals, by uterine hæmorrhages, vomiting, and abundant purgation. This woman confided to two of her neighbours, that her illness was occasioned by powdered arsenic, which her husband, *in concubito*, had himself insinuated into the parts. The body was examined by the proper officers. They declared that they found the vulva and vagina in a state of gangrene—the abdomen much distended with air, and the intestines inflamed and gangrenous. The culprit was arrested, convicted and executed.

It is also mentioned, that the Copenhagen College of Medicine, when the case above cited was referred to them, and when some doubted the possibility of this mode of poisoning, made some experiments by introducing arsenic into the vagina of mares. It produced inflammation, tumefaction, and death. On dissection, the genital parts were found gangrenous, and there was an effusion of bloody serum in the abdomen, with traces of inflammation in the stomach, intestines, lungs, aorta, thoracic duct, &c. London Med. Repository, vol. 9, p. 246, from the *Journal de Medicine*. See also, with reference to this mode of administration, the case mentioned in page 164, vol. 2.

† Orfila, vol. 2, p. 541.

EXTERNALLY, *(a) Applied to a wound or ulcer, or even to the skin.*

Of this, there are some instructive cases on record. Dr. Desgranges relates the following :—A chambermaid had been so imprudent as to rub her head with an ointment containing a portion of arsenic, for the purpose of destroying vermin. Her head was perfectly sound, without the least scratch. But in six or seven days after, it began to swell; the ears, which were twice their natural size, became covered with scabs, as were also several parts of the head; all the glands of the jaw and neck rapidly enlarged; the face was tumefied, and almost erysipelatous. Her pulse was hard, tense and febrile; the tongue parched, and the skin dry. To these were added excruciating pain, and a sensation of great heat. Vertigo, fainting, cardialgia, occasional vomiting, thirst, ardor urinæ, constipation, trembling of the limbs, and delirium were also present. Dr. Desgranges treated the complaint as an inflammatory disease, and in a day or two after, the body, and especially the hands and feet, were covered with a considerable eruption of small pimples, with white heads like millet. This eruption in time dried up and desquamated, and she finally recovered, but during her convalescence the hair fell off.*

Belloc has recorded a similar instance. A female aged fifty-six, in good health, but of a delicate constitution, had the imprudence to wash her body with a solution of arsenic in water, to cure the itch. Her body swelled prodigiously, and she was covered with an erysipelatous eruption. She dragged out a painful existence for two years, but during life, was always afflicted with a trembling of the limbs.†

Roux amputated the schirrous breast of a girl of eighteen. The wound did well, but while rapidly closing, an ulceration, accompanied with slight darting pains, made its appearance in the centre. He

* Foderè, vol. 4, p. 123. † Belloc, p. 121.

applied the *arsenical paste*, as it is called in France, and of which arsenious acid is the basis. The day after, she was seized with violent colics, and experienced some vomiting. Two days afterwards, she died in violent convulsions. The body, which was covered with large ecchymoses, quickly putrefied, and on opening it, the internal surface of the stomach, and a great part of the intestinal canal, were found in a state of inflammation, and sprinkled over with black spots.*

To these I will only add the following. A lady found some arsenic, and not knowing what it was, put a little in her mouth, in order to taste it. She was certain, however, that she had not swallowed any of it. No manifest effects occurred immediately, but in twelve hours she became vertiginous, and convulsions supervened, and continued during the day and night. The day following, her body, but especially her head, face and neck, were all covered over with red spots like measles, with excessive glowings and *tinnitus aurium*. Her other symptoms, however, began to abate, and in five or six days she recovered, but remained deprived of a fine constitution for several years.†

There can be no doubt, that the various quack preparations used both in England, France, and this country, for the cure of cancer, and which have arsenic for their base, have in most cases proved destructive to the patients. Certainly governments ought to interdict their application, except in the hands of regular practitioners.‡

* Orfila, vol. 1, p. 124.

† Case by Dr. Thomson, in Edinburgh Med. Essays, vol. 4, p. 41.

‡ In France, the *pate arsenicale* is used. It consists of cinnabar 70 parts, sanguis draconis 22, and arsenious acid 8, made into paste at the time of applying it. In England, *Plunkett's ointment*, made of arsenious acid, sulphur, and the powdered leaves of the ranunculus flammula and cotula fœtida; and *Davidson's remedy for cancer*—arsenious acid and powdered hemlock. (Paris' Pharmacologia, p. 209.) In the United States, *Davison's cancer plaster*—some preparation of arsenic.—As far back as the time of Haller, cases are related of death ensuing from the external application of arsenic to cancers and ill-conditioned ulcers. (Edinburgh Med. and Surg. Journal, vol. 14, p. 643.) Dr. Francis mentions a case, where an ointment contain-

During the period of the plague of London, amulets of arsenic were worn suspended over the region of the heart, as a preservative against infection. Even this proved dangerous, and Dr. Mead severely reprehends it.

(b) By inhaling its vapours.

I have already adverted to the effects produced on the miners in Germany, and will now mention those caused in the copper smelting works of Cornwall and Wales, in consequence of that metal in its crude state being mixed with arsenic. Dr. Paris states, that in their vicinity, "horses and cows commonly lose their hoofs, and the latter are often seen in the neighboring pastures crawling on their knees, and not unfrequently suffering from a cancerous affection in their rumps, whilst the milch cows, in addition to these miseries, are soon deprived of their milk. The men employed in these works are more healthy than we could *a priori* have supposed possible, but the antidote on which they rely with confidence, whenever they are infected with more than an ordinary portion of arsenical vapour, is *sweet oil*, and an annual sum is allowed by the proprietors in order that it may be constantly supplied."

It deserves notice, he adds, that the smelters are occasionally affected with a cancerous disease in the scrotum, similar to that which infests chimney sweepers.*

The effects of the vapours of arsenic in the laboratory are no less marked. "Whilst Tachenius (says Van Swieten) endeavored to fix the arsenic, by repeated sublimations, the vessels being open, he inspired a very sweet air, but in a half hour, felt the consequences of his imprudence. He not only breathed with difficulty, but suffered convulsions in all the members of his body, and passed bloody urine

ing arsenic was applied to a tumour. Paralysis shortly followed—every joint seemed to be enlarged and tumid—the intellectual functions were nearly destroyed, and death *ensued suddenly and unexpectedly*. New-York Med. and Phys. Journal, vol. 2, p. 28.

* Paris' Pharmacologia, p. 209.

with great pain."* Dr. Gordon mentions the following as occurring to himself. Whilst subliming arsenic, the vessel broke from the heat, and on removing it hastily from the fire, he inhaled a small quantity. A sense of pain and tightness about the præcordia was immediately felt, with a difficulty of breathing and violent cough. The pulse was not changed, but weaker and quicker than natural. On the next day, all the symptoms were gone except the cough, nausea and anorexy. These were removed by a cathartic.†

Appearances on dissection. According to the division previously adopted, we shall separate these into two classes, and notice first the appearances of such as survive several days.

The cases of this class are few in number, and they are liable to lead to wrong inferences, since from the length of time, other causes, as previous disease, or the action of remedies, may modify their results. I shall follow my former guide at this time, and then mention some additional cases. "In three cases," he observes, "the body is mentioned as discoloured or marked with livid spots, in one even blistered, and one was highly fetid. Two only were examined internally. In one, the intestines were inflated, and the intestines and stomach red, with turgid vessels; in the other, the fauces and stomach were yellow, and the heart, spleen and lungs, dark blue."‡

Mr. Henry Earle communicated a case to Mr. Brodie, of a woman in St. Bartholomew's hospital, who had taken arsenic, but who recovered of the immediate symptoms. She died at the end of four or five days, and on examination, extensive ulcerations were found in the mucous membrane of the stomach and intestines.

The case related by Mr. Murray, and which has been already noticed, is very interesting, inasmuch as the individual lived seven days, and during that

* Gordon, p. 15. † Ibid p. 16.
‡ Edinburgh Med. and Surg. Journal, vol. 7, p. 87.

period, retained a considerable portion of strength. His body was examined three days and eight hours after death. The right ear and scalp were of a deep blue colour. The back, from head to foot was livid, on the chest and belly there were several spots and streaks, some green and others blue, while the shoulders and neck were mottled with livid ones. The penis was much swollen and red, and the scrotum was enlarged and of a dark blue colour. On opening the abdomen, several ounces of a high coloured liquid were found. The outer surface of the stomach, along the whole of its larger curvature, was of a dark red colour, strongly marked. On opening that viscus, its internal surface was found of a brighter red, with lighter spots interspersed. The duodenum, through nearly its whole extent, and round it, was of a dark purple colour, and its internal coats were pulpy, thickened, and easily seperated from the peritoneal covering, while in one roundish spot, of the size of a crown piece, the villous and muscular coats were entirely wanting. Red patches were also observed on the inner surface of the jejunum and ileon. The stomach and duodenum contained about a quart of a brown semi-opaque, thickish liquid. The lungs and heart were healthy. The spleen was gorged with blood, and the liver healthy. The pharynx was of an unusually red colour.*

Metzger quotes a case from Zittman, where two grains of arsenic were first administered, and in two days after, an emetic. Four days after, the dose of arsenic was repeated. On dissection, eight ounces of coagulated blood was found in the stomach, and this viscus was covered with gangrenous spots. The heart resembled a baked pear (a une poire sortant du four.)†

Lastly, a case is mentioned by Lieutaud, where a man who took a drachm, died in eight days. The

* Edinburgh Med. and Surg. Journal, vol. 18, p. 170.

† Metzger, p. 388. He also mentions that he has noticed inflammation of the liver in this class of poisoning, p. 392

stomach was deprived of its villous coat, and was filled with fluid and charry matter. The pylorus was gangrenous. The intestines of a reddish black colour.*

The appearances observed on those who die after a few hours illness, are sufficiently various, although they agree in some leading particulars. The following may be deemed a correct abstract drawn from the histories of between twenty and thirty cases.†

The external appearance of the body is not uniform. In some, probably in a majority of cases, it is marked with livid stripes or patches, of various sizes, and in others with small ecchymoses. Several instances are related, where the posterior part was

* Bigsby, in London Med. Repository, vol. 5, p. 101.

† In preparing this, I have derived great assistance from the Edinburgh Med. and Surg. Journal as already quoted, but particularly from a paper in the London Med. Repository, (vol. 5, p. 97,) entitled, "*On the effects of arsenic as they appear in the human body after death*, by J. J. Bigsby, M. D. of the York Hospital, Chelsea. The author classifies the appearance of each viscus in columns, notices the age of each individual, and the time which elapsed between taking the poison and death. The cases analyzed by him are twenty in number, viz:—1. A woman aged 44, died in 9 hours—from *Wolfius*, in Ephemerides Nat. Cur. 2. A girl aged 5 years, died in 12 hours—*Davies*, in London Med. and Phys. Journal. 3. Woman aged 60, died in 12 hours—*Morgagni*, Epist. Anat. 69, Ar. 3. 4. A man, died in a very short time—*Morgagni*, Epist. Anat. 69, Art. 5. 5. Child, died in 12 hours—*Elmuller*, Ephem. Nat. Curios. 6. Woman, dose half an ounce, died in 13 hours—*John Hunter*, Transactions of a Society for the promotion of medical and chirurgical knowledge, vol. 2, p. 63. 7. Woman aged 27 years, died in 15 hours—*Laborde*, (Orfila.) 8 Woman aged 18, died in 15 hours—*Orfila*. 9. Man died in 16 hours—*Bonetus*. 10. Child aged 8 years, died in 21 hours—*London Med. Repository*, vol. 2, p. 270. 11. Boy 17 years, died in 21 hours—*Dr. Velloly*, Edinburgh Med. and Surg. Journal, vol. 5. 12. Child, died in 24 hours—*Foderè*. 13. Child 3 years, died in 33 hours—*Davies*, London Med. and Phys. Journal, vol. 28, p. 345. 14. Woman, time unknown—*Whately*, Med Observ. and Inquiries, vol. 6, p. 337. 15. Woman, time unknown—*Jones*, Orfila, vol. 1, p. 140. 16. Man died in eight days, dose one drachm—*Lieutaud*. This I have already noticed. 17. A child, mentioned by *Wepfer*. 18. Man mentioned by *Chaussier*, Edinburgh Med. and Surg. Journal, vol. 7, p. 92. 19. A man, quoted by Orfila from Marc. 20. A man, quoted by Orfila from Sallin.—To these I may add the following:—21. The astonishing case by Metzger, as already mentioned. (Schlegel, vol. 4, p. 21.) 22. Man aged 22, died in about five or six hours—*Soden*, in London Med. Review for April, 1811. (Eclectic Repertory, vol. 2, p. 325.) 23. A man aged 19, took an ounce, died in seven hours—*Pettigrew*, from his Anniversary Oration, London Med. Repository, vol. 11, p. 525. 24 & 25. Two cases examined by *Deveaux* Foderè, vol. 4, p. 263. 26. A boy eight years old, lived 21 hours—London Med. Repository, vol. 2, p. 270.

black, and in one case the body was swoln, and of a bluish green colour.*

In one case the tongue was inflamed and thickened. In three, the œsophagus was found inflamed, and in one of these, the symptoms during life, and the appearances after death, were very mild, but in the other two, both were violent.

The nature of the contents of the stomach has been various, both as to colour and consistence, and this of course depends greatly on accident. In twelve cases out of twenty-three, arsenic in substance was found among the solids and fluids, while in a few instances, the most minute chemical investigation could not detect the least trace.

The villous coat of the stomach is very generally in a high state of inflammation, but in three cases none was discoverable. In twelve cases, this coat was found eroded or abraded, and this was often seated in a diffuse surface of intense inflammation. The erosions have the form of angular, or somewhat circular depressions, with regularly defined or ragged

* Gmelin says, that in some cases the hair, nails, and joints have separated on the application of the slightest force. It is, however, very doubtful whether, according to the assertion of some writers, *putrefaction* follows rapidly after death. It would rather seem, from the result of experiments on animals, that bodies do not mortify sooner from this cause, than from many other diseases. Metzger, in a case examined eighteen days after death, and eight days after burial, found no fœtor, or sign of putridity, and there were no livid spots, except on the ends of the fingers. (Metzger in Schlegel, vol. 4, p. 22.) Professor Pfaff, of Kiel, examined a body poisoned by arsenic, and although it had laid fourteen days in the grave, yet putrefaction had not made any visible progress. (London Med. and Phys. Journal, vol. 16, p. 95.) Dr. Welper, of Berlin, has made similar observations, and found the bodies changed in some degree to the state of mummies. (Gordon, p. 24.) There is also a curious case related by Dr. Gordon, from the Trans. of the Phys. Med. Soc. of Erlangen, 1812. A servant-maid poisoned three heads of families with oxide of arsenic. Suspicion was not excited for a length of time, but the bodies were finally dug up. One had been buried two years, the second, fourteen months, and the third, five months. Putrefaction had progressed very slowly. The skin resembled mahogany, and cut like the rind of an old cheese. The adipose substance, and muscles of the abdomen, were converted into a mass resembling lard or cheese, (adipocire ?) and the peculiar odour from the graves resembled fœtid cheese. No poison could be detected by the use of tests. Dr. Bachman was ready to hang the female, and endeavoured to support his opinion by various cases, tending to show that the administration of arsenic retarded putrefaction. The female, however, confessed her crimes, and thus prevented the necessity of acting on this doubtful, or at least imperfect proof. Gordon, p. 22 to 27.

edges, in which, and on the surface, pieces of arsenic were very commonly discovered, and in one case actually agglutinated to the parts. This substance has also been seen adhering to the inflamed portion of the stomach, with an increase of the morbid effect in its vicinity. The abrasions are of various dimensions, and in extremely violent cases, extend over the whole cavity, and leave the rest of the stomach extremely thin, and almost transparent.

Sometimes the villous coat is very easily separable. The inflammatory process seems to be proportionate to the time that elapses between death and the exhibition of the poison, and relatively according to the empty or full state of the stomach at the time, and the medical treatment employed.

The muscular coat is not often named, but in violent cases it is also affected. Corrugation of the stomach is a very common appearance.

The peritoneal coat is not often affected, but when it is so, it is found inflamed. In milder cases, the stomach has been found thickened in several places, as if by coagulable lymph ; and in one case, indeed, a thickening of the coats was the only alteration observable.

Gangrene was observed in three cases, near the pylorus.

The intestines partake of similar disease, but not so violently. The mucous membrane of the duodenum in particular, is usually inflamed to a high degree—it has even been eroded. Portal has observed it actually perforated with a ragged orifice. The inflammation declines gradually in passing down the intestines, and usually disappears in the larger ones, although they have been met with of a reddish black colour.

Three cases are mentioned, two by Dr. Baillie, and one by Mr. Davies, where, on examination, the rectum was seen diseased : in one instance, high inflammation, and in the remainder, ulcers and gangrene.

The peritoneal coat of the intestines is sometimes

more vascular than natural. The duodenum and jejunum have been seen thickened, and the colon corrugated.

The liver is often spoken of as sound, but in one case it was grey, and in another gorged with blood.

The bladder was in one instance whiter than usual on its internal surface, and in Mr Soden's case, it was contracted to the size of a walnut.

The lungs are very generally described as affected. In some instances they are livid, or have livid spots on their surface. In one case they were inflated, and in another flaccid.

The brain has seldom been examined. It is generally natural, but in one history it is stated as unusually turgid on its external face, and the plexus choroides as very vascular.

The heart is usually natural. Its cavities are often found filled with fluid blood. In one case it was flaccid.

The blood seems to have differed very considerably—at one time being black and coagulated ; at another, black and fluid ; and at a third, florid and fluid.

Effects of arsenic on animals. This deserves consideration, from the light it may afford in determining on the nature of symptoms and morbid appearances in the human system. Several able observers and experimentalists have directed their attention to this point, and I shall notice the more important results obtained by them.

Dr. Jaeger, of Stuttgard, examined the effects of this substance on all classes of organized bodies, vegetable and animal ; and most of his experiments were made with a solution of the white oxide in water, in the proportion of one to sixteen. He found it a general and quick poison for plants at every period of their life, with the exception perhaps of a few of the simplest forms of vegetable existence. Their various parts died in succession, as the particles of the poison reached them. In animals, death was preceded in every instance, from the infusory animal-

culæ up to man, by inordinate motions, and the secretion of lymph was increased most remarkably from the mucous membranes. Frequent fluid stools took place in all classes of animals; in those in which mucus is secreted on the surface, it was remarkably increased, and crabs ejected a great deal of froth from the bronchial openings. The power of voluntary motion, and susceptibility for external stimuli, decreased; the respiration of those animals which breathe by lungs, became difficult and laborious, and warm-blooded animals experienced extraordinary thirst. In birds and mammalia, frequent and violent vomiting took place, and commonly was the commencement of the scene to which convulsions put an end. Rabbits, however, which ruminate, did not vomit.

Arsenic exerted the most powerful effects when it was injected into the veins, or applied to a bleeding wound;* next, when it was introduced into the stomach, but less so when it was injected into the large intestines, which have fewer absorbing vessels. Applied to the sound skin, and to a wounded muscle, if dry, it seldom produced any effect; and animals covered with scales or shells, did not suffer at all from the external application of arsenic. Applied directly to the nerves, it was inert. Lastly, he found that animals were never killed more certainly or quickly by arsenic, than when it was injected into the abdomen. But upon this he lays no stress, as the same effect was produced by most infusions.

In whatever way the arsenic was applied, Dr. Jae-

* There can be no doubt of the truth of this statement. Dr. Gordon quotes the following experiments, given to him by his friend Dr. Campbell, which prove how *small* a quantity *externally* applied is sufficient to destroy life. Five drops of a saturated solution of the white oxide of arsenic were placed in a wound in the neck of a young cat. The animal was seized with vomiting, and died in four days. The stomach internally was much inflamed near the pylorus, and the small intestines were also greatly inflamed both internally and externally. In another instance, two drops of *arsenic acid* (the effects of which only differ in being more powerful and rapid) were put on the head of a cat, and she was dead in 24 hours. Vomiting took place, and the stomach and œsophagus were inflamed. Gordon, p. 19.

ger observed after death no change upon the skin. The gullet, and in birds the crops also, exhibited generally a slight redness; and further down, purple-red stripes, more numerous in the vicinity of the cardia, which, as well as the stomach itself, in animals having a soft villous coat to their stomachs, was sometimes of an uniform purple-red colour, and sometimes spotted with it. The muscular stomach of graminivorous birds, however, shewed no appearance of redness; and in the aponeurotic portion of the stomach of a horse poisoned by arsenic, there were no traces of inflammation, which was otherwise general. The villous coat of the stomach is almost always softened, and as if macerated, and also somewhat swollen; and in general, it can be easily torn, or rubbed off in pieces with the finger, from the coat beneath it. The inflammatory redness is not seated in the villous coat, which remains perfectly white, but in the nervous coat, which is remarkably red, and exhibits every where purple-red warts or eminences. The author, however, often saw this separation of the villous from the nervous coat, without any inflammatory redness of the latter. These changes continue, though in a less degree, through the small, to the vicinity of the large intestines, which are in general free from them, and only contain an increased quantity of effused mucus; but the rectum again is inflamed, and its inner coat swollen and softened. These appearances are not constant, and are very various in degree.

The other mucous membranes were less generally affected, but he sometimes found the trachea red and inflamed, and in one instance the urethra of a dog. In no instance, real inflammation of the peritoneum, but its vessels were always turgid with stagnating blood. The voluntary muscles were constantly and universally rigid; the limbs sometimes bent, but generally extended; the heart, urinary bladder, gall-bladder and intestines, were rarely contracted, but frequently distended by their contents. The veins, especially of the abdomen, were constantly turgid.

with much black fluid blood, and a similar stagnation was observed in the cavities of the heart, especially of the right side. The lungs in general were natural, as was also the brain.

Putrefaction seemed neither to be hastened nor retarded by their being poisoned with arsenic, whether they were buried or not. The generation of infusory animals, the production of larvæ and subterraneous vegetation in and about the bodies of poisoned animals, took place as usual. Dr. Jaeger was particular in these observations, from its being a disputed point. He, however, remarked, that the immediate contact of the arsenical solution, seemed in some degree to retard the putrefaction of the part, to which it was applied in sufficient quantity.

As to the local effects of arsenic, he observed that when applied to the sound skin, it seldom injured it. If applied to a wound, it never, after death, was observed to be gangrenous or inflamed—was rarely swollen, but generally pale; and for a considerable extent, the subcutaneous cellular membrane was filled with much stagnant, gelatinous fluid. The œsophagus, stomach and intestines, were commonly, though not always, inflamed when arsenic was administered by the mouth. He never noticed real erosions, ulcerations, and gangrene of the viscera. In the horse already mentioned, and into whose jugular vein two ounces of arsenical solution were injected, and which was put to death twenty-nine hours afterwards, there were only some discoloured spots in the left ventricle.*

Mr. Brodie, of London, performed numerous experiments on animals with arsenic, and in doing so, either applied it to a wound, or injected it into the stomach. The results were similar in all essential circumstances. The symptoms were, 1. Paralysis of the hind-legs, and afterwards of the other parts of

* Review of Jaeger's Inaug. Dissert. *de Effectibus Arsenici in Varios Organismos*, &c. in Edinburgh Med. and Surg. Journal, vol. 7, p. 80 to 84.

the body; convulsions, dilatation of the pupils of the eyes, and insensibility. 2. A feeble, slow, and intermitting pulse. 3. Pain in the region of the abdomen; preternatural secretion of mucus from the alimentary canal, and sickness and vomiting in those animals which are capable of vomiting. These three classes of symptoms respectively indicate disorder of the heart, brain, and alimentary canal. Mr. Brodie also found that the symptoms occurred sooner when the arsenic was applied to a wound, than when it is given internally.

In whatever way the poison is administered, the inflammation is confined to the stomach and intestines. He never observed any appearances of it in the pharynx or œsophagus.* This inflammation took place more readily indeed from the external application of the poison, than from its administration internally, and it preceded any appearance of inflammation of the wound. The degree of inflammation varied considerably. In some it was very slight, in others considerable, and it appears to be greater or less according to the time which elapses before the animal dies. The mucous membrane of the stomach and intestines assumes a florid red colour—becomes soft and pulpy, and is separable without much difficulty from the cellular coat, which has its natural appearance. In some instances, there are small spots of extravasated blood on the inner surface of the mucous membrane, or between it and the cellular coat, and this occurs independently of vomiting. Mr. Brodie never found ulceration or sloughing of the stomach or intestines, but he suggests, that if the animal survives for a certain length of time after the inflammation has begun, it is reasonable to conclude that it may terminate in

* Dr. Campbell, however, in several experiments with the white oxide externally applied, found the *œsophagus greatly inflamed*. This appearance was witnessed by Dr. Gordon. (Gordon, p. 20.) Orfila mentions it as a common circumstance in persons dead from poison, and he also quotes a case in which it was distinctly observed. (Orfila, vol. 1, p. 140.) See also the cases of Blandy and Ogilvie hereafter cited.

one or other of these ways. And it is important not to mistake the layers of coagulated blood for sloughs.*

I shall lastly mention the result of a number of experiments made by Dr. Duncan, Jun. and Dr. Campbell. They are summed up by the former as follows. "1. Arsenic does not act chemically on animal matter, living or dead. 2. Its chief effects are to produce a disease somewhat analogous to cholera morbus, whether it be taken directly into the stomach itself, or inserted into the subcutaneous cellular membrane of a remote part, or applied to a delicate membrane. In some few cases, where the action of the poison is most intense, death occurs from the sickness or fainting, without vomiting or purging. 3. Frequently a considerable interval intervenes between its being received, even in solution, into the stomach, and its action. 4. Neither paralysis of the voluntary muscles, nor convulsions, nor delirium, nor coma, nor disordered respiration or circulation, are ordinary symptoms of the disease produced by arsenic. 5. After death, we were frequently unable to discover any organic lesion, and we generally found that the inflammation was less, in proportion as the arsenic was more speedily fatal."†

As a supplement to these quotations, I may add some facts which were elicited on an extraordinary trial, which took place in 1812, in England. The prisoner, Daniel Dawson, was indicted for poisoning several horses at Newmarket. He effected this by injecting arsenical solution, with a syringe, into the watering troughs. Shortly after taking it, the animals staggered and rolled about in great agony, and they appeared to be in great pain from the intestines. Mr. Bowles, veterinary surgeon, opened a colt and found the stomach and intestines extensively inflamed. He also mentioned in his testimony, that he had

* Edinburgh Med. and Surg. Journal, vol. 8, p. 459, from Phil. Transactions. From his experiments, Mr. Brodie draws the conclusion, that arsenic does not produce its deleterious effects, until it has passed into the circulation.

† Edinburgh Med. and Surg. Journal, vol. 11, p. 127.

poisoned horses by way of experiment, and on opening one of them, the same appearances were found as in the colt. The water in the trough was proved to contain arsenic, and the additional testimony was so conclusive, that the prisoner was condemned and executed.*

Chemical proofs. These form the third and most important mode of proof, in cases of poisoning, and I shall state the numerous ones proposed for the detection of arsenic, with as much conciseness as possible, although I may at the same time observe, that the ample discussion which all of them have undergone, renders a full notice very necessary.

Some remarks on the solubility of arsenious acid, are previously requisite. Chemists formerly differed greatly in their statements on this point. According to Bergman, eighty parts of water at the temperature of sixty degrees, dissolve one part, while the same quantity is dissolved by fifteen parts of boiling water. Navier asserts that eighty parts of boiling water are requisite to dissolve one of the oxide; while according to Hagen, thirty grains require four ounces of boiling water to dissolve them. These discordant results led Klaproth to investigate the accurate proportions, and the results of his experiments are as follows. Four hundred parts of *cold* water at the temperature of sixty degrees dissolve one part of white oxide, while only thirteen parts of *boiling* water are requisite to dissolve the same quantity. He also examined how much of the oxide would be retained by the boiling water, after it was cold, and found that one hundred parts of water retained three of the oxide, and the remainder separated in the form of tetrahedral crystals.†

Chemists have very generally assented to the cor-

* Edinburgh Med. and Surg. Journal, vol. 8, p. 351. Edinburgh Annual Register, vol. 5, part 2, p. 112. Some systematic writers assert that arsenic is innoxious to horses, but certainly the above facts contradict this opinion.

† Annals, vol. 4, p. 132. Klaproth suggests that the cold of winter may produce some modifications in the latter proportions.

rectness of these experiments,* and the practical direction to be drawn from them is, that boiling water should be employed in all cases which require examination. It is also advisable to employ a somewhat larger proportion of water than is indicated above.

It may also be mentioned, that alkohol, in the proportion of eighty parts, dissolves one of arsenious acid.†

The methods proposed for detecting the presence of arsenic, are 1. The application of certain re-agents or tests to its solution, and 2. Its reduction to a metallic state. Of the first class, the following may be mentioned.

(a) Lime water. This gives a fine white precipitate, with arsenious acid, of arsenite of lime, soluble however in an excess of the arsenious solution.—Among the Germans, it appears to be a favorite test. Jaeger recommends that it should be used recently prepared and hot. He found it sufficiently delicate to precipitate one thirteenth of a grain of arsenic when dissolved in one hundred grains of water, or one fortieth in fifty grains.‡

(b) Ammoniaret of copper has also been recommended by German chemists as a very delicate test. In the state of saturated solution, it strikes an evident green colour with a solution of the white oxide, containing one five-hundreth of a grain dissolved in fifty grains of water.‖ Orfila, who in his work calls it the *sulphate of ammonical copper*, observes, that this test, of all those furnished by copper, deserves the preference, on account of its extreme sensibility. It must however be noticed, he adds, that if this sul-

* The experiments of Fischer led him to the result, that white oxide of arsenic is insoluble in water, and that it must be changed into an acid by combining with a greater portion of oxygen, before this can take place. Mr. Richard Phillips has, however, fully shown the incorrectness of this opinion. Annals of Philosophy, vol. 7, p. 33, and vol. 8, p. 152.

† Brande, p. 264.

‡ Edinburgh Med. and Surg. Journal, vol. 7, p. 84. Lime-water enters into the processes recommended by Rose and Fischer. See Orfila, vol. 1, p. 135 and 136.

‖ Jaeger.

phate of ammoniacal copper be much concentrated, the precipitation will not take place.*

An objection of importance has however been pointed out by Rose against it. If any of the fluids to be operated on, contain tannin, as tea for example, this re-agent will produce no effect.† This is evidently calculated to weaken its value.

(c) Scheele's green is another test derived from the application of a salt of copper to the arsenious acid. It is so named from its discoverer. In his Chemical Essays, he directs that a certain quantity of sulphate of copper be dissolved in water, and that this solution be aided by heat. The same quantity of the potash of commerce, and a less portion of the white oxide of arsenic are then to be dissolved, in another vessel, in water. The latter solution is to be strained through linen, and a small quantity of it added from time to time to the dissolved sulphate of copper. A beautiful grass-green precipitate is deposited, which on being washed and dried, forms the paint in question.‡

Dr. Bostock has examined this test with considerable attention. He recommends the following proportions: white oxide of arsenic one part, potash three parts, and sulphate of copper five parts, as best calculated to produce the required appearance; and in order to discover the degree of minuteness to which it

* Orfila, vol. 1, p. 106. † Jaeger.

‡ Murray's Chemistry, vol. 3, p. 356. "To a little of the arsenical solution, add a single drop of the solution of *carbonate* of potash, and a few drops of a solution of sulphate of copper. The presence of arsenic will be manifested by a yellowish-green precipitate." (Henry, vol. 2, p. 270.)—"Arsenite of copper, called Scheele's green, is prepared by the old prescription of mixing a solution of two parts of sulphate of copper in 44 of water, with a solution of two parts of *potash of commerce*, and one of arsenious acid, also in 44 of water." (Ure, Art. *Copper.*) "To the solution of arsenic, add a drop of solution of *subcarbonate* of potassa, and then a drop or two of solution of sulphate of copper. An apple-green precipitate indicates arsenic." (Brande, p. 270.) I add these formulæ, because it has been denied that Scheele's green is ever obtained by using the *subcarbonate of potash*. Pure or caustic potash, it is asserted, is necessary. The quotations now made, evidently disprove the correctness of this opinion, but it must be added at the same time, that a solution of pure potash is best calculated to produce the characteristic appearance. See Henry, vol. 2, p. 270.

is capable of being carried, he dissolved one fortieth of a grain of arsenic in sixty grains of water, forming one two thousand four hundreth of the whole weight of the fluid ; the proportion of potash and sulphate of copper was then added, and the result was, that the green was perfectly obvious.

It deserves mention also, that if the sulphate of copper and potash be added to each other, without the arsenic, a delicate *sky-blue* is produced, instead of the *grass-green* precipitate.

In commenting on this test, Dr. Bostock remarks, that we should always view the fluid by reflected, and not by transmitted light, and that when we come to minute experiments, they should be examined by day light. "By the light of a candle," he adds, "it is difficult to distinguish between delicate shades of blue and green, and a weak solution of sulphate of copper, without any addition, when held between the eye and the window, frequently presents a greenish tinge. Coloured fluids *are best seen by placing a sheet of white paper behind the glasses in which they are contained.*"*

The value of this re-agent was very generally acknowledged until the occurrence of a trial for poisoning, in Cornwall, in 1817. The particulars of this case are detailed below.† And it is only necessary

* Edinburgh Med. and Surg. Journal, vol. 5, p. 169.

† *Robert Sawle Donnal*, surgeon, of Falmouth, was tried at Launceston, in Lent assizes, 1817, for poisoning Mrs. Elizabeth Downing, his mother-in-law, and also of Falmouth. It appeared in evidence, that Mrs. Downing had breakfasted and dined at the prisoner's house in October, and returned home very ill, retching and vomiting, with a very violent cramp ; and she continued so three or four days after. On the 3d of November, she was prevailed on, after much persuasion, to drink tea with him again. She was then in perfect health, and had just come out of church. Cocoa was provided for her, and whilst drinking part of the second cup, she was taken very sick. She was soon after put to bed, and died about eight o'clock next morning. Mr. Richard Edwards, a physician of Falmouth, was called to visit the deceased on the 3d of November. He found her very drowsy, and her pulse fluttering. The prisoner considered the disease as *cholera morbus*, but in the opinion of Dr. Edwards, cholera morbus would not produce death in less than two or three days. On dissection, the stomach was found inflamed and soft, and its contents, when tested by the sulphate of copper and the ammoniaco-nitrate of silver, gave the characteristic appearance of arsenic. On the part of the prisoner, several physicians deposed that the symptoms stated resembled those of cholera morbus, and also that

to mention here, that a physician, (Dr. Neale,) swore that on adding the sulphate of copper and potash to a decoction of onions, he found a green precipitate produced, resembling that caused by arsenic in combination with them. Subsequent experiments by other persons have however hardly confirmed his assertion in its full extent, but they have left a degree of uncertainty sufficient to injure its character in a material manner.

Dr. Paris asserts, that from a fair and appropriate series of experiments, he has satisfactorily established, that the above opinion was grounded on an optical fallacy, arising from the *blue* precipitate assuming a *green* colour, in consequence of having been viewed through a yellow medium. As for example, "a few drops of a solution of sub-carbonate of potash were added to the decoction of onions—its colour deepened to a reddish yellow ; the sulphate of copper was then applied, when a precipitate fell down, which was deemed to be of a *vivid green* hue, but on pouring off the supernatant liquid, and transferring the precipitate on white paper, it assumed a blue colour, without the least tinge of green."* He adds that the yellow colour imparted to the liquid by the alkali, will generally take place on adding it to the infusions of vegetable substances.

Mr. Marshall, of London, performed several experiments with the decoction of onions, but the agent applied by him was somewhat different, being the ammoniaco-sulphate of copper. The filtered liquor of the decoction was tested with this salt, and it caused a very slight hue of green ; on adding twelve drops

this disease frequently destroyed the patient in 24 hours. Dr. Neale swore that he had tried the above tests on a decoction of onions, (the deceased had eaten onions on the day when she died,) and found both the green and yellow precipitates which they yield when applied to arsenic.

These were the leading medical facts elicited on the trial, although there was some circumstantial evidence leaning against the prisoner. He was acquitted.—[I have derived this statement principally from English newspapers of the above date.]

* Paris' Pharmacologia, p. 215. These experiments should all be made on a piece of writing paper, and not in a glass.

more, a permanent *transparent grass-green* colour was produced, but no *cloud* or *precipitate* could be perceived. When an equal quantity of the decoction and distilled water was tested in the same way, the tint of grass-green still occurred, but it was not so strong; and finally, when two drachms of the decoction, were diluted with one ounce of distilled water, no visible alteration was induced by the application of the sulphate.*

The distinction which Mr. Marshall draws between the onions and arsenic, is, that with the former, the green *colour* only is produced without any *precipitate*, while with the latter, a very palpable sediment is caused. Unfortunately, however, even this will not answer. "*A very dilute solution of arsenic produces no precipitate with the test;* and again, a decoction of onions, or other mucilaginous vegetable, prevents the production of a precipitate, when it would otherwise have taken place."†

It is evident that the importance of the test in question, is greatly impaired by these circumstances. It should only be used as an adjunct to other and more decisive ones.‡

(d) A solution of *sulphuretted hydrogen* in water, freshly prepared, is also a very delicate re-agent, and

* Marshall on Arsenic, p. 152. These experiments account for the discrepancy noticed between some trials made in this state in 1818, in consequence of the noted Kesler case. Dr. M'Neven added the sulphate of copper to the *expressed juice* of onions, and immediately the whole turned of a beautiful green. Dr. Low bruised and *macerated* an onion in distilled water, but the addition of the sulphate produced no change in the colour. The one was evidently stronger than the other.

† Edinburgh Med. and Surg. Journal, vol. 13, p. 519. It would seem, by Dr. Porter's experiments, that coffee added to a solution of sulphate of copper and carbonate of potash, *without arsenic*, also produces a green precipitate. (Silliman's Journal, vol. 3, p. 355.) But this is probably owing to the circumstance already noticed, of viewing it through a glass, and not on a piece of writing paper—by transmitted, and not by reflected light. Quarterly Journal of Foreign Medicine and Surgery, vol. 5, p. 307.

‡ It will greatly tend to determine the nature of the suspected substance, if we *follow up*, as it were, some of the precipitates with other tests, and ascertain whether the characteristic effects are produced. Thus, for example—"Take the arsenite of copper, wash it well, and then add sulphuretted hydrogen water, the colour will change to a brownish red. Ferroprussiate of potash changes it to a blood-red; nitrate of silver converts it to a yellow arsenite of silver. Finally, reduce the precipitate." Ure, Art. Arsenious Acid.

throws down the arsenic in a golden yellow precipitate.* So minute indeed is the operation of this substance, that Mr. Children found it to give a decided yellow colour to an ounce measure of distilled water, containing only one drop of a saturated solution of arsenious acid, equal to $\frac{8}{100}$ of a grain of the solid acid, or about $\frac{1}{5700}$th of the whole weight of solution.† Jaeger states that he detected the arsenic in the same manner, in a solution which contained the $\frac{1}{1000}$th part of a grain of absolute weight, and in which it bore the proportion to the water, of one to 50.000 or 60.000.‡

There are, however, some results affecting this test which deserve mention; and one of these is the fact noticed by Mr. Children, that two or three drops of phosphate of soda added to the arsenical solution, prevented the action of the sulphuretted hydrogen.‖ Should, therefore, this substance be contained in the fluids of the stomach or intestines, it would necessarily counteract the expected effect.

Another circumstance is indicated by Dr. Bostock, who, however, examined the test in a modified form. He used an *alkaline hydro-sulphuret*, (of potash) in his experiments. Ten drops of a strong solution of the sulphuret were diffused in an ounce of water, and to this, four drops of a saturated arsenical solution were added. Immediately, an orange coloured cream

* On this point the following quotations are submitted to the consideration of chemists. "If water saturated with sulphuretted hydrogen, be added to a solution of arsenious acid, a golden-yellow *sediment* will fall down." (Henry's Chemistry, vol. 2, p. 270.) "Sulphuretted hydrogen gas and hydro-sulphuretted water, *precipitate* a golden sulphuret of arsenic." (Ure, Art. Arsenious acid.) "Sulphuretted hydrogen gas and hydro-sulphurated water throw down the arsenious acid in a yellow golden *precipitate*." (Orfila, vol. 1, p. 104.)—Now, on the other hand, Mr. Children observes, "If a current of sulphuretted hydrogen be passed into fluid containing arsenious acid, it will occasion the *appearance of a fine lemon-colour* through the liquid." (Annals, New Series, vol. 1, p. 142.) And Mr. R. Phillips says, "The aqueous solution of sulphuretted hydrogen gas, when added to the aqueous solution of arsenic, produces a yellow-coloured solution, *without any precipitate*." (Annals, New Series, vol. 1, p. 227.) Is this discrepancy as to *precipitate* or *no precipitate*, owing to the minute quantities of each used by the latter chemists?

† Annals, New Series, vol. 1, p. 143.

‡ Edinburgh Med. and Surg. Journal, vol. 7, p. 65.

‖ Annals, New Series, vol. 1, p. 143. A very little dilute (pure) acetic acid, however, immediately produces the yellow colour.

formed itself at the surface of the fluid, which in the course of twenty-four hours, had nearly subsided, leaving a precipitate of the same colour at the bottom of the glass. Other substances were now added to the solution of the sulphuret, and the effect produced by two of them deserves notice. A drop of sulphuric acid caused the whole to assume a light milky appearance, and after some time, a delicate yellow precipitate rose to the surface of the fluid, and coated the sides of the glass. The same experiment was performed with a saturated solution of tartarized antimony; it required a larger quantity of it to produce the same effect, but by the addition of ten drops, the appearances that presented themselves were very similar to those where the arsenical solution had been employed, as the precipitate rose to the surface and assumed a deep orange hue. He adds, that as to the first, (the sulphuric acid) a sufficiently clear distinction is afforded by the colour of the substances, as the sulphur preserves its peculiar light yellow, while the arsenic presents a deep shade of orange, but between the hydro-sulphurets of arsenic and of antimony, there is greater difficulty of discrimination, since the colour of the precipitate, and the mode of its formation are very similar.* The only variation was, that more of antimony was required to produce the effect, than of arsenic.

These results certainly prove that sulphuretted hydrogen is not a test to be *solely* depended on, but they are also very far from impairing its general value.—We shall hereafter indicate means by which all doubts as to the presence of antimony can be obviated, while the application of tests presently to be mentioned

* Edinburgh Med. and Surg. Journal, vol. 5, p. 167. Orfila observes, that the hydro-sulphurets do not in any manner disturb the solution of arsenious acid, at least until a few drops of nitric or muriatic acid be added to the mixture. In this case, the same golden-yellow precipitate is obtained as from sulphuretted hydrogen. We must be careful not to confound them and the liver of sulphur, which is a hydrogenated sulphuret of potash, and gives in small quantity a white, and in large, a yellow precipitate, but it never acquires the beautiful gold-yellow colour in question. Orfila, vol. 1, p. 104, 105.

to other portion of the suspected substance, will suffice to corroborate the deduction drawn from its effects. Chemists certainly ought never to neglect employing it, since it will detect arsenic under circumstances, when the other tests are nugatory or deceitful.*

An aqueous solution of sulphuretted hydrogen gas, is in many respects the preferable form of applying this test, and it should be preferred to a solution of an hydro-sulphuret, or to passing the gas itself through the suspected substance.†

(e) The nitrate of silver was proposed by Mr. Joseph Hume in 1809, as a test, and his directions for applying it are as follows: "Into a clear Florence oil flask, introduce two or three grains of any powder suspected to be arsenic; add not less than eight ounce measures of either rain or distilled water, and heat this gradually over a lamp, or a clear coal fire, till the solution begins to boil. Then, while it boils, frequently shake the flask, which may be readily done by wrapping a piece of leather round its neck or putting a glove upon the hand. To the hot solution, add a grain or two of sub-carbonate of potash or soda, agitating the whole to make the mixture uniform. In the next place, pour into an ounce phial or a small wine-glass about two table spoonfuls of this solution, and present to the mere surface of the fluid, a stick of dry nitrate of silver or lunar caustic. If there be any arsenic present, a beautiful yellow precipitate will instantly appear, which will proceed from the point of contact of the nitrate with the fluid, and settle towards the bottom of the vessel as a flocculent and copious precipitate."‡

This is evidently a convenient and striking test, but it is to be regretted that its utility is impaired by

* See the subsequent table of its effects on mixtures of arsenic with various articles of food or drink.

† Wendland, a chemist at Berlin, has recommended the *hydro-sulphuret of ammonia* as superior to the other alkaline hydro-sulphurets. On adding a few drops of nitric acid to its mixture with arsenic, the yellow precipitate falls down. Marc, p. 90. See, however, Orfila, vol. 1, p. 104.

‡ Henry's Chemistry, vol. 2, p. 272.

many serious objections.* It has been attempted from time to time to obviate these, and to render the proof infallible, but not with perfect success. As the progress of improvement with respect to it is curious, and particularly as it behoves every medical jurist thoroughly to understand this subject, I shall state the various modifications in their order.

1. It is evident that cases of poisoning occur more frequently from arsenious acid simply, than from arsenite of potash, (Fowler's solution,) and hence the test should be applicable to a solution of the former substance. Now according to Dr. Marcet, arsenious acid alone will not decompose the nitrate of silver, while it is well known that the pure fixed alkalies produce that effect.† To avoid the confusion which might arise from the latter circumstance, Dr. Marcet suggested the superior advantages that would attend the use of ammonia. *This alkali, when added singly, does not decompose the nitrate of silver.*

The following mode of applying the test, thus modified, has been published by Dr. Roget, as the direction of Dr. Marcet: "Let the fluid suspected to contain arsenic, be filtered—let the end of a glass rod, wetted with a solution of pure ammonia, be brought into contact with this fluid, and let a clean rod, similarly wetted with a solution of nitrate of silver, be brought into contact with the mixture. If the minutest quantity of arsenic be present, a precipitate, of a bright yellow colour, will appear at the point of

* The 60th part of a grain may be recognized in *two ounces of water, by means of this test.*

The arsenite of silver, which is the substance thus produced, is of an orpiment-yellow colour when first formed, but if allowed to stand for some time in an open vessel, it gradually becomes brown, and it has this colour when dry. It is insoluble in water. Before the blow-pipe, the silver is reduced, and the arsenic is totally dissipated. *Marcet.* Annals, vol. 3, p. 236.

† I mention this on the authority of Marcet and Paris, (see Pharmacol. p. 212,) although Orfila states expressly, that the "*nitrate of silver is immediately precipitated by the solution of arsenious acid,* and the precipitate, which is of a yellow colour, grows black on exposure to light." (Orfila, vol. 1, p. 105.) See also the results obtained by the editors of the London Med. Repository, where this test detected arsenious acid, although its quantity dissolved in twelve drachms of water, did not amount to one sixty-fourth of a grain. Vol. 6, p. 343.

contact, and will readily subside to the bottom of the vessel."* This was so efficient as to show the presence of arsenic when the fluid examined contained only the two hundred and fifty thousandth part of a grain.†

2. A student at Guy's Hospital, suggested to Dr. Marcet, that when nitrate of silver is added to a solution containing an alkaline phosphate, a yellow precipitate is thrown down, similar in appearance to arsenite of silver; hence an ambiguity might readily occur in suspected cases, as an alkaline phosphate might be present in the fluids of the stomach. This fact induced Dr. Marcet to examine the subject anew. He found the shades of colour in the two salts, not quite alike, yet sufficiently resembling each other, to render the test a dubious one in judicial cases.‡ Mr. Richard Phillips made several experiments on it, and repeatedly obtained, without any regard as to proportions in either case, precipitates of arsenite and phosphate of silver, resembling each other so perfectly, that it was impracticable to distinguish them.‖

In order to obviate the difficulty thus discovered, and still to render the test available, Dr. Paris proposes the following method: "Instead of conducting the experiment in glasses, drop the suspected liquor on a piece of white paper, making a broad line with it. Along this line, a stick of lunar caustic is to be slowly drawn, when a streak is produced of a colour resembling that known by the name of *Indian Yellow*; and this is alike obtained by the presence of arsenic

* Medico-Chirurgical Transactions, vol. 2, p. 157, 160. The utility of applying the test in this way, is evident from the fact, that an excess of ammonia re-dissolves the precipitate.

† "When the solution contained only the 25,000th part of a grain of arsenic, the precipitate was of a bright yellow. It was still distinctly yellow, when the quantity of arsenic was reduced by dilution to one 50,000th of a grain. When further diluted, the yellowness grew less and less discernible, and the precipitate appeared of a light blue. It retained this colour until its quantity became too minute for observation. A bluish cloud was, however, distinctly visible, when the fluid examined contained only the 250,000th part of a grain of arsenic." Roget, in Medico-Chirurg. Transactions, vol. 2, p. 160.

‡ Medico-Chirurg. Transactions, vol. 6, p. 663.

‖ Annals, vol. 8, p. 152. Ditto, New Series, vol. 1, p. 142.

and of phosphoric salts—but the one from arsenic is rough, curdy and flocculent, as if effected by a crayon; that from a phosphate, homogeneous and uniform, resembling a water colour laid smoothly on with a brush. A more important and distinctive peculiarity soon succeeds—for in less than two minutes, the phosphoric yellow fades into a *sad* green, and becomes gradually darker, and ultimately quite black, while on the other hand, the arsenical yellow remains permanent, or nearly so, for some time, when it becomes brown. In performing this experiment, the sunshine should be avoided, or the transition of the colour will take place too rapidly."* Mr. Thomson observes, that this result will be rendered more satisfactory, by brushing the streak lightly over with liquid ammonia immediately after the application of the caustic, when if arsenic be present, a bright queen's yellow is produced, which remains permanent, for nearly an hour; but that when the lunar caustic produces a white-yellow before the arsenic is applied, we may infer the presence of some alkaline phosphate, rather than that of arsenic.†

Mr. Hume has, however, formed a triple compound, the *ammoniaco-nitrate of silver*, which obviates two difficulties, and it is therefore a valuable addition to our means of analysis. It avoids the danger of an excess of ammonia, which might re-dissolve the yellow precipitate, and it does not effect in the least the phosphate of soda. The following is the formula for its preparation: "Dissolve ten grains of lunar caustic in ten times its weight of distilled water; to this add, *guttatim*, liquid ammonia, until a precipitate is formed; continue cautiously to add the ammonia, repeatedly agitating the mixture, until the precipitate is nearly re-dissolved." The object of allowing a small portion to remain undissolved, is to guard against an excess of ammonia. Whenever the test is used, the liquid to which it is added ought to be quite cold.‡

* Annals, vol. 10, p. 60.
† Paris' Pharmacologia, p. 213. London Med. Repository, vol. 8, p. 178.
‡ Paris' Pharmacologia, p. 214. Marshall, p. 99.

3. Dr. Paris mentions another objection to the use of the nitrate of silver, which is, that it produces such copious and flocculent precipitates with the muriates, as to overcome every indication which the presence of arsenic would otherwise afford.* Dr. Marcet proposes to obviate this difficulty by adding diluted nitric acid to the fluid, and then cautiously apply the nitrate of silver until the precipitate ceases. In this way, the muriate of silver, which is insoluble, immediately resumes its peculiar density and whiteness, while the arsenic, if it be present, will remain in solution, and may be rendered evident by the effusion of ammonia, which will instantly produce the yellow precipitate in its characteristic form.† Dr. Paris, however, objects to this, that the yellow precipitate thus produced, is not always permanent, since it is soluble in the nitrate of ammonia formed during the process, and he recommends that we should give the nitrate of silver its full power of precipitation, and then submit the mixed precipitate to a low heat in a glass tube, when the arsenious acid will be immediately separated by sublimation. He recommends this process also in cases where animal and vegetable substances, as milk, broth, or wine, are mixed with the suspected fluid.‡ Of this, however, I shall speak hereafter.

4. The last objection to the correctness of this test has been already noticed, as occurring on a trial for poisoning. A decoction of onions, however, when treated with the ammoniaco-nitrate of silver, presents no *precipitate*, and the colour, which at first is a reddish yellow, gradually changes to a deep red.‖ But the same objections which I mentioned when noticing the ammoniaco-sulphate of copper, are also urged against the infallibility of this result.§

* Mr. Sylvester was, I believe, the author of this objection. See his paper on the detection of metallic poisons, copied from Nicholson in the Eclectic Repertory, vol. 4, p. 450.

† Marcet in Medico-Chirurg. Transactions, vol. 3, p. 346.

‡ Paris' Pharmacologia, p. 214.

‖ Marshall, p 150.

§ It is to be regretted, that the reviewer in the Edinburgh Med. and Surg.

I am apprehensive that all these objections go far to weaken the value of the test under notice. But I would, notwithstanding, always have it applied in the form of ammoniaco-nitrate of silver, and principally for this reason, that it will furnish us with a copious precipitate, ready for any further experiments that we may require to perform.*

These are the tests that have attracted most attention. Others, however, have been lately proposed, which it is proper briefly to mention.

(f) Iodine is recommended by Brugnatelli, to be applied in the following manner : "Take a little recent wheat-starch, add to it a sufficient quantity of iodine to give it a blue colour ; mix a little of this blue matter with water, so as to have a blue coloured liquid. If into this liquid a few drops of an aqueous solution of arsenious acid be put, the blue colour is immediately changed to a reddish-brown, and is gradually dissipated entirely. If a few drops of sulphuric acid be now added, the blue colour is again restored."† This is said to have failed in the hands of succeeding experimenters.‡

(g) It has lately been suggested by Mr. Smithson, that the fusion of arsenic, or any of its compounds, with *nitrate of potash*, will give us a result, (arseniate of potash) that is well calculated to detect the most minute portions of poison. On the addition

Journal has not favoured us with the experiments on which he founded these statements. I venture, however, from the ability displayed in this work on subjects relating to medical jurisprudence, to place implicit reliance on its assertions. It is another question, whether in judicial investigations, we should attach much importance to the fact under consideration. The judge, on the trial of *Donnal*, very justly remarked, "*that the onion liquor was always thrown away, and the vegetable itself only used.*" And the emetic and cathartic effects of a poison would certainly remove all marks of their presence, even if they had been eaten.

* Professor Dana, of Dartmouth college, has recommended a mode of applying this test, which deserves mention. Pour a few drops of nitric acid over the suspected substance ; evaporate to dryness by a gentle heat—repeat this, and the arsenic will be converted into arsenic acid. If the substance has previously given a *yellow* precipitate with Marcet's test, and now on dissolving the arsenic acid gives a *brick-red* with it, we have certainly a strong testimony as it respects the nature of the mineral. New-England Journal, vol. 6, p. 135.

† Annals, vol. 10, p. 151.

‡ London Med. Repository, vol. 8, p. 160.

of nitrate of silver, the brick-red precipitate is formed in a very large proportionable quantity.*

(h) The chromate of potash. This substance has been highly recommended by Dr. Thomas Cooper, as a test of arsenic. His direction is, to add a few drops of it to the filtered solution, or to a grain of white arsenic in substance, and in about half an hour a bright grass-green colour will be produced. The rationale of this experiment is, that the arsenious acid attracts oxygen from the chromic acid, which is thus converted into a green oxyd and precipitates, while the alkali unites with the arsenic acid. By this means, Dr. Cooper says that a twentieth part of a grain, whether in powder or solution, can be detected.†

It is remarkable that while Dr. Cooper was offering this as a test, Dr. Porter, a graduate of Yale College, without a knowledge of his publication, should have obtained results with it, that apparently invalidate several of those already stated.

When the chromate was substituted for arsenic in the production of Scheele's green, a precipitate was thrown down which was not to be distinguished by the eye from the latter substance.

When Marcet's test was applied to a solution of chromate of potash, a yellow precipitate was produced, which, "when placed side by side with one produced by arsenic, could not be distinguished by their colour and appearance."‡

Dr. Cooper has objected to the correctness of most of these results, and among other things remarks, that with Marcet's test, a brown tinge of chromate of silver will be produced.

I am, however, far from considering the results of Dr. Porter as of great importance, and adopt on this point the words of Dr. Cooper: "As to the prepara-

* Annals, New Series, vol. 4, p. 127.

† Cooper's Tracts, p. 444. Silliman's Journal, vol. 4, p. 159.

‡ Silliman, vol. 3, p. 354. Prof. Silliman seems to sanction the correctness of these experiments.

tions of chrome, they are so very unlikely to occasion mischief either by accident or design, that they may be considered quite out of the question" in our investigations on suspected substances.*

Further experiments are, notwithstanding, requisite to determine the value of this salt as a test of arsenic; and I would suggest, whether there may not be other acids, which, like the arsenious, possess the power of deoxidating the chromic acid.

The following directions require attention in all our experiments with tests. 1. In every experiment with an unknown substance, a corresponding one should be made on ingredients of a known composition. If, for example, the operator is about using the copper or the silver test, he should first apply it to a solution prepared by himself, and known to contain arsenic. He will thus become familiar with the expected results. 2. Never commence the experiments until the tests, and all the necessary apparatus, are in readiness, and in a perfect state.† 3. If the experiments are performed in glasses, examine them by day-light, and view them by reflected, and not by transmitted light. A piece of paper should also be placed behind the glasses. 4. It will be proper to repeat the experiments on white paper, as suggested by Dr. Paris; or what is better, "take a pane of glass, put a few drops of the clear liquid in the middle, and draw lines out from it in different directions. To one of these, a particle of weak ammoniacal water being applied, the weak nitrate of silver may then be brushed over it with a hair pencil. By placing the glass in different lights, either over white paper, or obliquely before the eye, the slightest change of tint will be perceived." The sulphuretted hydrogen may be applied to another filament of the drop, and so on with all the tests. This is the mode practised by Dr. Wollaston, in general chemical research, and it

* Silliman, vol. 4, p. 159.
† Bostock, Edin. Med. and Surg. Jour. vol. 4, p. 174.

is admirably adapted for detecting small quantities of a substance.*

Of the second class, or the reduction of the white oxide to a metallic state, the following must be mentioned.

(a) Its reduction with the black flux. Take any of the precipitates produced by either of the foregoing tests, and evaporate it to dryness with a gentle heat, or take the suspected powder, if it has been found in a solid state, and "mix a portion with three times its weight of *black flux*, (consisting of finely powdered charcoal one part, and dry carbonate of potash two parts,) put the mixture into a thin glass tube, hermetically closed at one end, about eight inches in length, and one fourth of an inch in diameter. Should any of the powder adhere to the sides of the tube, it must be carefully brushed off with a feather, so that the inner surface of its upper part may be perfectly clean and dry. The closed end of the tube, by way of security, may be thinly coated with a mixture of pipe-clay and sand, but this operation is not absolutely necessary, and the open extremity is to be loosely plugged with a piece of paper."† The coated end is now to be heated on a chaffing dish of red hot coals, or it may be heated red hot in the flame of a spirit-lamp, or we may urge it with the blow-pipe until it comes to that state. In either case, if arsenic be present, it will sublime, and form a brilliant metallic crust, resembling steel, and lining the upper part of the tube.

This mode of proving the presence of arsenic, is undoubtedly most decisive and satisfactory, and it is therefore of great importance that no imperfection should attend it.

In the first place, it should never be attempted on a suspected substance, unless the operator has pre-

* Ure, art. Arsenious Acid

† Paris' Pharmacolog. p. 210. Dr. Bostock, however, seems to be of opinion, that the coating of pipe-clay and sand should not be omitted. Edin. Med. and Surg. Jour. vol. 5, p. 171

viously performed repeatedly on what he knows to be arsenic. He should be familiar with the appearance of this metal in very minute quantities. Dr. Paris observes, that to his knowledge, it has happened to a medical person, by no means deficient in chemical address, to ascribe to the presence of arsenic that which was no other than a film of very finely divided charcoal.* This advice, then, WHICH APPLIES TO ALL THE CHEMICAL PROOFS, is emphatically important in the present instance.

2. I should next recommend, when the suspected substance is small, that this experiment be not attempted, until the operator has applied all the tests he intends to use. Let the precipitates then be investigated in this way. The reasons why we should prefer this are, that the tube may break during its heating, and we may lose a part or the whole of the arsenic; while, on the other hand, the bulk of the precipitates will increase the facility of examination. But above all, I should enforce this direction from the simple fact, that the *reduction of the metal in this way*, is not *alone* a sufficient proof. I put this observation in strong language, that I may be distinctly understood; and I ask those chemists, who of late years have agitated the community with their denunciations against tests, whether they intend that the *steel lustred coating* of metallic arsenic, developed by the above process, is of itself sufficient to prove a criminal guilty? The language used in their writings, would certainly warrant such a deduction. But the truth, I apprehend, is, (and it has not been explained with sufficient explicitness,) that the reduction of the metal is the *confirmatory*, the *decisive* proof; because the previous experiments with tests, have indicated the presence of poison, and they should therefore precede its use.

3. Dr. Bostock remarks, that powdered charcoal added to the arsenic, will answer every purpose required in this process. This, however, is probably

* Paris' Pharmacologia, p. 217.

incorrect. The presence of potash in the flux would seem to be very essential, since it immediately forms an *arsenite of potash*, and thereby fixes the arsenious acid, and prevents it from being volatilized before the the temperature is sufficiently high to enable the charcoal to decompose it.*

4. As to the minuteness of this proof, Dr. Bostock observes, that when less than three-fourths of a grain was employed, the metallic coating was not clearly perceptible, and from a remark of Dr. Black, he concludes that that chemist considered one grain as the smallest quantity which he thought capable of detection by this process.† Later experimenters, however, assert that they have obtained satisfactory results with smaller quantities. Rose states that he was able to detect in this way the one-eighth of a grain, mixed with animal matters.‡ And Dr. Gorham, of Harvard University, obtained a distinct metallic film from one-eighth of a grain.‖

(b) The garlic smell.—Take a portion of the suspected substance, and place it on red-hot charcoal, or a piece of red-hot iron. It will evaporate with a white smoke, and a peculiar smell resembling garlic.

This is an uncertain and equivocal test. Phosphorus, zinc and antimony, under the same circumstances, burn with a similar odour,§ and even if it be arsenic, yet mixed with either a vegetable or animal substance, the smoke and smell arising from these bodies when heated, will altogether prevent us from detecting the peculiar properties of the arsenic. Dr. Bostock mixed equal parts of arsenic and flour, and placed them on iron at a low red heat, but the suffocating smoke arising from the flour could alone be perceived.¶

* Paris' Pharmacolog. p. 211.

† Edin. Med. and Surg. Jour. vol. 5, p. 170. ‡ Ibid. vol. 7, p. 85.

‖ See a valuable and instructive analysis, by Prof. Gorham, of some poisoned sugar, in the New-England Journal, vol. 6, p. 228.

§ Edin. Med and Surg. Journal, vol. 7, p. 85. Murray's Chemistry, vol. 3, p. 358. Ballard denies that phosphorus emits a similar odour, and observes, that zinc may always be detected by its flocculent oxyd. P. 395.

¶ Edin. Med. and Surg. Journal, vol. 5, p. 173. Jaeger, however, says

There is also some discrepancy among chemists, as to the condition which is necessary to produce this garlic smell. Dr. Henry remarks, that "this odour is not produced by the white oxide of arsenic when heated, without the addition of some inflammable ingredient." And he adds, "the absence of arsenic must not therefore be inferred, if no smell should be occasioned by laying the white powder on a heated iron."* Murray says, "if, before being evaporated, the oxide is made into a paste with oil, it will, when evaporating, present the peculiar smell resembling that of garlic."† Orfila, however, and others, assert that the same will happen if it be thrown upon a plate of copper or iron previously heated to redness, and makes no mention of an inflammable ingredient.‡

The reason of this diversity, as well as its proper explanation, appear to have been but lately understood. We have the testimony of two experimenters, that *arsenious acid* possesses no alliaceous smell, and that it is peculiar to the arsenic volatilized in its *metallic state.* If, therefore, the arsenious acid yields this odour, we may infer that its decomposition has taken place, and this is of course facilitated by its projection on red-hot charcoal, or by heating it in contact with bodies which readily unite with its oxygen. Dr. Paris found that the garlic smell only occurred in cases of its projection on copper *in a state of ignition,* but if heated on a plate of copper by a spirit-lamp or blow-pipe, no odour was perceptible, and the arsenious acid was dissipated before the copper could acquire a degree of temperature sufficient to deoxidize it.‖

By properly understanding this phænomena, precautions may be taken to prevent its failure. The

he was sensible of the garlic smell of the tenth of a grain mixed with sugar!

* Henry, vol. 2, p. 273.

† Murray, vol. 3, p. 357.

‡ Orfila, vol 1, p. 103.

‖ Paris, in Brande's Journal, vol 6, p. 342. R Phillips, in Annals, New Series, vol. 2, p. 227. When Dr. Paris employed metals that are oxidizable with difficulty, as gold, silver, or platina, no alliaceous smell could be produced at any temperature.

correct course undoubtedly would be, to take a portion of the reduced metal obtained by process *a.* and project it on red-hot iron. We will thus be furnished with the accessary testimony that is required, if it be arsenic.*

(c) The tombac alloy.—"*Mix the suspected substance with black flux, as in experiment* a, *and place the mixture between polished plates of copper—bind them tight together by iron wire, and expose them to a low red heat. If the included substance contained arsenic, a silvery white stain will be left on the surface of the copper, which is an alloy of the two metals.*"†

Dr. Bostock, in his remarks on this test, gives a preference to charcoal instead of the black flux, but if there be any correctness in the remarks already made, as to the necessity of potash to fix the arsenious acid, this is evidently incorrect.

The following experiment made by him, affects the excellence of the proof under notice. "Two copper disks, of nearly an inch and a half in diameter, scoured bright with sand, had one grain of powdered charcoal, made into a paste with oil, placed between them; they were bound together with an iron wire, and then kept red-hot for ten minutes. When they were withdrawn from the fire, the metal was found to have lost its former appearance, and to have acquired the dull white colour of lead or zinc. The inside of the disks were found to present the same whitish appearance, except on the spot where the charcoal was placed, a small part of which still remained unconsumed. As the disks cooled, the whitish matter which covered them began to separate, and fly off with some force, in the form of small scales, leaving a clear surface of the proper copper colour. In a few minutes, the greatest part of the scales removed, ex-

* A remark of Ballard also deserves attention at this time. Many bodies, he observes, may give out either an alliaceous odour, or a dense white smoke, when placed on burning charcoal, but *arsenic alone produces both.* Ballard, p. 395.

† Copper, whitened in this manner, tarnishes very soon. Bostock.

cept on the inside near where the charcoal had been placed, and here the disks still retained their grey colour. The charcoal was rubbed off, and the surface below it was found smooth and polished ; it had acquired a light colour, resembling that of brass, and near the centre there was a small spot which approached to a steel-grey. This appearance still continued after it had been rubbed with fine sand."

The above description, he observes, of the changes which the disks experience, by being heated with a part of their surface in contact with an inflammable body, impressed him with the idea, that if he had performed this experiment upon a substance which was suspected to contain arsenic, and had not been aware of the appearances that he had to meet with, he would have conceived, that he had detected its presence. "Upon repeating the process, in precisely a similar manner, except that one grain of arsenic was added to the charcoal, the oxidation of the copper took place as before, and a small part of the charcoal remained unconsumed ; but upon rubbing it, the white stain was perfectly visible. However, when these disks were compared with those in which the former experiment had been made, the difference between them seemed more in *degree* than in *kind ;* so that I should not choose to decide upon the presence of arsenic as indicated by this test, unless the result was more obvious than it must be expected to be, when it exists only in small quantity."*

Dr. M'Neven put *oxide of tin* between two plates of bright copper, and surrounded it with a circle of powdered charcoal : the plates were then brought to a red heat, and the consequence was a whitish stain towards the edges of the copper. So also when *calomel* was used ; but the whitening was irregular and not so distinct.†

These experiments evidently regulate the value of this mode of proof. It can only be used as an ac-

* Edin. Med. and Surg. Jour. vol. 5, p. 172.
† Journals of the Assembly of the state of New-York, for 1818.

cessary, and in that case, is valuable. But the operator should perform it at the same time with a substance that he knows to be arsenic, and be well aware of all the peculiarities that attend this particular alloy.

(d) The reduction of the metal by the galvanic pile. This was suggested by Jaeger, in consequence of the discoveries of Sir Humphrey Davy.* And Orfila has given directions for performing the experiment in his work. The simplest and best mode probably will be, to "let the two wires act on a little of the arsenical solution placed on a piece of window glass." The negative pole will, if arsenic be present, be coated at the end of twelve, fifteen, or four and twenty hours, with a white metallic crust; and if the pole in question be of copper, it will be whitened like tombac. Sometimes even a longer time is required to produce this effect. A pile of fifty pair of plates, of an inch diameter, revives a solution containing only $\frac{1}{60}$ or $\frac{1}{40}$ of solid arsenious acid, but when the quantity of arsenic is extremely small, it is impossible to perceive the revived metal. In that case, by heating the negative wires after the operation, the smell of garlic is perceived.†

After this enumeration of the various modes of detecting the presence of arsenic, it becomes an important question, whether any extraneous difficulties may occur in performing them. The patient is supposed to be dead; his body has been opened, and the appearances found on dissection have been duly noticed. The fluid or solid substances, or all contained in the stomach, have been collected.

With respect to the *solid substances*, our course is evidently plain, according to the directions already given. They should be washed in distilled water, then boiled in a proper proportion of it, according to the directions mentioned when speaking of the solubility of arsenic—portions of this fluid must then be

* Edin. Med. and Surg. Jour. vol. 7 p. 85.
† Orfila, vol. 1, p. 108. Ure's Dictionary, art. *Arsenious Acid.*

tested by the ammoniaco-sulphate of copper, the ammoniaco-nitrate of silver and sulphuretted hydrogen—the precipitates are next to be evaporated to dryness, then reduced with the black flux; a portion of this metal is thrown on red-hot iron, and another portion placed between two copper plates and heated.

But as to *fluids*, we shall experience greater difficulty. They are often mixed with animal or vegetable substances in the stomach; the matter vomited, which may be all that we can operate on, may be in the same combination, and the question then arises, will not these foreign substances alter the results expected from tests, and if so, how are we to obviate this?

To the first, we have to answer, that undoubtedly a great variety has been observed from the mixture of animal or vegetable substances. The example of a decoction of *onions*, already noticed, is a striking proof of this. Again, *muriate of soda* is usually present in the fluids of the stomach, and this has been found materially to obstruct the operation of one of the tests, viz. the nitrate of silver. In such a case, the experiment with it and the ammonia should be repeated several times. At first, if the muriate be present, a white curdy precipitate will only be formed, but at the second or third immersion of the nitrate rod, a central spot of yellow will be perceived, surrounded by the white muriate of silver. At the next immersion, this yellow cloud on the surface will become very conspicuous.* Orfila has diligently investigated this point, and ascertained the effect of various substances on arsenic, and the appearances developed by the application of tests to these compounds. I have thrown this in a tabular form, and it will be seen that all are more or less affected, except sulphuretted hydrogen.†

* Ure, art. Arsenious Acid.

† Dr. Ure, in his Chemical Dictionary, mentions that Mr. Thomson, in his London Dispensatory, has given a tabular extract of these results. I have not been able to procure this work, but the present table is probably precisely similar.

Effects of Tests on various mixtures of Arsenic with Animal and Vegetable Substances.

Substances employed.	Strong decoction of tea and arsenious acid, equal parts.	Decoction of coffee and arsenious acid, equal parts.	Wine ten parts, arsenious acid one part.	Wine ten parts, arsenious acid seven parts.	Albumen and arsenious acid.	Gelatine and arsenious acid.	Broth and arsenious acid.	Bile and arsenious acid.	Milk 10 parts, arsenious acid one part.	Milk ten parts, arsenious acid 2 or 3 parts.	Fluid in the stomach of a rabbit poisoned with three grains.
Effect of the substances on each other.	No effect.	No effect.	Preserved transparency.		No effect	No effect	No change.	No change.			
TESTS. Nitrate of silver	Yellowish white precipit. immediately black.	Deep yellow precipitate.	White.	White, *slowly*.	White.	White.	White.	Same as arsenious ac. alone	No visible change.	White.	White.
Lime-water.	Yellow precip. rather dirty.	Yellow precip.			Same as arsenious ac. alone	Same as arsenious ac. alone	Same as arsenious ac. alone.	Same as arsenious ac. alone.			Greyish white.
Sulphate of ammoniacal copper.	No disturbance, change to a reddish violet.	Nearly green precipitate.	Dark blue.	Green.	Same as arsenious acid alone	Same as arsenious acid alone	Colour dirty green, no prec.	Same as arsenious acid alone.	Tinge slightly green.	Green.	Green.
Sulphuretted hydrogen.	Yellow precip.	Golden yellow	Deep yellow.	Golden yellow.	Same as arsenious ac. alone.	Same as arsenious ac. alone.	Same as arsenious ac. alone.	Same as arsenious ac. alone.	Pale yellow.	Golden yellow.	Deep yellow.

If then the fluid be much disguised with animal or vegetable substances, it is better, first of all, to evaporate to dryness, and by a few drops of nitric acid to dissipate the organic product. The remainder can now be dissolved in distilled water, and will present a clear liquid.* A portion also, after it is thus evaporated, may be exposed to heat in a glass tube. The whole range of experiments may thus be applied—or, as has lately been suggested by Orfila, a sufficient quantity of liquid chlorine may be added to the suspected fluid. This will remove the colouring matter of various substances, such as wine, coffee, &c. and a reddish yellow matter will form and gradually be deposited; the whole supernatant fluid, on being filtered, will present the same results on the application of the various tests, as the aqueous solution does.†

I should not be doing justice to the student in medical jurisprudence, were I to dismiss the subject at this place. There remains a question of magnitude to be discussed, which is, *the degree of proof necessary to determine the fact that poison has been administer-*

* Ure *ut antea*. "Should the arsenic be combined with *oil*, the mixture ought to be boiled with water, and the oil then separated by the capillary action of wick threads. If with resinous substances, these may be removed by oil of turpentine. Both tea and coffee should be freed from their tannin by gelatine, which does not act on the arsenic, previous to the use of reagents for the poison." Ibid.

† Quarterly Journal. For. Med. and Surg. vol. 3, p. 246. London Med. Repository, vol. 11, p. 336. In a previous volume of the latter work, is contained a memoir by Orfila, in which he announces a new mode of detecting arsenic when combined with animal substances. The author of it is Mr. Rapp. It appears, that in his experiments, he was not able to cause the destruction of the animal matters by the nitric acid. He therefore suggests the following:—A given quantity of *pure nitrate of potash* is to be introduced into a glass vessel with a large neck, and the vessel placed in a sand-bath; this matter is to be heated to a beginning redness, and small pieces of the suspected matter being evaporated to dryness by a gentle heat, are then to be mixed with it. By these means, both the animal matter and the nitrate of potash become decomposed, and the arsenious acid is transformed into arsenic acid, which unites with the potash of the nitrate, and thus becomes arseniate of potash. As soon as the mass ceases to detonate, it is to be dissolved in water, and the excess of potash is to be saturated with nitric acid. The liquor thus obtained, is to be treated with the tests of the arseniates. (London Med. Repository, vol. 9, p. 514; vol. 10, p. 151.) The safest mode after all, however, is to collect the precipitates first obtained with the ordinary tests, evaporate them to dryness, and then reduce with the black flux.

ed ? The chemist will reply, that the reduction of the metal is the only certain and decisive evidence. I answer, it is the HIGHEST POSSIBLE proof, but it cannot always be obtained. Are we then in all cases of indictment, to acquit the prisoner, because this has not been accomplished ? This would certainly seem to be the bearing of some late observations, but I cannot persuade myself of its justice, nor of its conformity to the rules of criminal evidence.

The proofs of the administration of poison are threefold : the symptoms—the appearances on dissection, and the results obtained by chemical experiments. The first are undoubtedly equivocal ; they often accompany other diseases in a greater or less degree, and again they vary materially in individual cases. Hence the inference derived from them can only be partial, and must be supported by further proof. So also with morbid appearances. We have already shown in a previous page, what difficulties envelope this point. I do not desire to conceal either of these, but notwithstanding wish to contend, that there may be cases, in which the MEDICAL JURIST, (not the *chemist*,) would be justified in pronouncing that poison had been the cause of death. The following will illustrate my views.

A family residing in the parish of Keig, in Scotland, and consisting of two brothers and two sisters, were taken ill on the morning of the 19th August, 1821, shortly after eating breakfast. They were all previously in good health, and the dish of which they ate was porridge, consisting of milk, salt and meal. William Mitchell, one of the brothers, partook largely, but James, who perceived a sickening taste, took less than common, while the sisters had their usual quantity. They were all seized with vomiting, burning heat in the stomach, weakness and fainting, which continued for a considerable length of time, and William finally sunk after seven days, in the manner already described in a former page.* The others

* See page 184. Case by Mr. Murray.

gradually recovered, but great debility remained for some months. On dissection the stomach and intestines presented unequivocal marks of inflammation.*

No part of the salt and milk used that morning was to be found, but the remainder of the meal, and also the contents of William Mitchell's stomach and duodenum, were examined by several physicians and surgeons. No poisonous ingredient, however, could be detected.

In this instance, a family in good health was simultaneously attacked with symptoms that indicated a *common cause*, and there was no epidemic prevalent that would account for them. So violent, too, did the cause in question prove, that the individual who had partaken most largely, sunk under its effects. Under these circumstances, the brother-in-law of the deceased was tried, and the medical witnesses did not hesitate to give it as their opinion, that poison had been administered to his relatives. He afterwards confessed his guilt, and stated that he had perpetrated the crime by means of arsenic put among the salt, on the morning when the Mitchells were taken ill.*

But it may be asserted, that the frequent vomitings, and the length of time which elapsed previous to death, prevented the detection of the poison. How then did it happen, that in Dr. Roget's case, no proof of arsenic could be found in the fluids vomited? "When arsenic has been taken in substance," says Mr. Brodie, "small particles are frequently found entangled in the mucus, or extravasated blood; but where this is not the case, I have never known in an animal capable of vomiting, that arsenic could be detected in the contents of the stomach after death, though examined by the most accurate chemical tests, and Mr. Brande could detect none in the urine."—Orfila remarks, that "he has satisfied himself, that all animals which have taken this poison dissolved

* Cases of Poisoning, by Mr. Murray. Edinburgh Med. and Surg. Journal, vol. 18, p. 167.

in water, and had abundant vomitings before death, do not exhibit the least trace of arsenic, when the contents of the stomach are submitted to chemical analysis."*

In such cases, then, we should examine the matter passed by vomiting or by stool, if they can be obtained. It is even directed to take the stomach itself, cut in pieces, and dissolve it in nitric acid. The fluid thus obtained is to be filtered, and tested by the means already proposed.† But if no evidence is obtained by either of the modes, we can only rely on the remaining facts that are presented to us. And it must be strongly impressed on the mind of the medical witness, that in an instance of this nature, his opinions should be founded on a strong combination of circumstances, a marked peculiarity of symptoms, and a striking disorganization of parts.

I shall conclude this discussion with a narrative of some cases that have come before criminal courts. These form a commentary on the general directions, and illustrate the difficulties that medical witnesses have to encounter.

The case of Miss Blandy. This is peculiarly interesting, as it gives us the mode pursued to detect arsenic some seventy years since.

Mary Blandy was tried in Feb. 1752, at Oxford, for poisoning her father with arsenic. It appears that she fell in love with a Capt. Cranstoun, and that her father was averse to her marriage with him. The wretch then seems to have formed the plan of de-

* Orfila, vol. I, p 140.

† Orfila, vol. I, p. 134. Gordon, p. 31. It is a most interesting question, and richly deserving of examination, whether the poison can be absorbed, so as to obtain traces in the manner now described. I copy the following from a late journal. "In order to ascertain whether or not the serous effusion which commonly occurs in the pleura of animals poisoned by arsenic, arises from the absorption of this mineral, M. Laissaigne, of Alfort, submitted the mediastinum of a horse destroyed by arsenic, to chemical analysis, by which means he detected its presence." (New-York Medical Repository, vol. 22, p. 111.) And while this work has been passing through the press, I have met with a case, where the method above directed was found the only effectual one by which the *poison could be detected in its metallic state.* I have quoted it at length in a subsequent page.

stroying him, in order to obtain possession both of his daughter and his property, and for this purpose forwarded arsenic to Miss Blandy, which she was induced from time to time to mix in his food and drink. It produced prickings and heat in his tongue and throat, and burning and pains in his stomach and bowels, which went off with vomitings and purgings. His health sunk under this dreadful regimen, and in particular, he observed that his teeth decayed very rapidly. Several females who had accidentally taken of the tea in which the poison was mixed, were also seized with vomitings and purgings, and suffered greatly. At last, on the 6th of August, she appears to have added a larger quantity than usual to his water gruel. He was attacked with all his former symptoms, but with double violence; the abdomen swelled, and there was excessive pain and prickings over every part of his body. On the 10th, Dr. Anthony Addington visited him, and found his tongue swelled, his throat slightly inflamed and excoriated, his eyes inflamed, his pulse low, trembling and intermitting, and his respiration difficult. There was also an inability to swallow even the smallest quantity. The patient stated that he had had several bloody stools. During the next two days, he appeared somewhat relieved, except that the rectum was ulcerated and painful, but on Tuesday, (13th) a slight delirium, with a short cough, and ulcerous discharges from the rectum supervened, and death ensued on Wednesday.

On Thursday, the body was examined. "The back and hinder part of his arms, thighs and legs, were livid. The heart was variegated with purple spots. The lungs resembled bladders half filled with air, and blotted in some places with pale, but in most with black ink. The liver and spleen were much discoloured; the former looked as if it had been boiled, but that part of it which covered the stomach, was particularly dark. The kidneys were stained with livid spots. The stomach and bowels

were inflated, and appeared, before any incision was made into them, as if they had been pinched, and extravasated blood had stagnated between their membranes. They contained nothing, but a slimy, bloody froth. Their coats were remarkably smooth, thin and flabby. The wrinkles of the stomach were totally obliterated. The internal coat of the stomach and duodenum, especially about the orifice of the former, was prodigiously inflamed and excoriated. There was no schirrus in any gland of the abdomen, no adhesion of the lungs, nor indeed the least trace of a natural decay in any part whatever."

A portion of the powder found at the bottom of the gruel administered to Mr. Blandy, was handed to Dr. Addington. He gave a part of this to Mr. King, a chemist in Reading, who examined it, and declared it to be white arsenic. On the remainder he experimented himself, and came to a similar result. The question was asked him, Why do you believe it to be white arsenic? He replied, "For the following reasons:—1. This powder has a milky whiteness; so has white arsenic. 2. This is gritty, and almost insipid; so is white arsenic. 3. Part of it swims on the surface of cold water, like a pale sulphureous film, but the greatest part sinks to the bottom, and remains there undissolved; the same is true of white arsenic. 4. This thrown on red-hot iron, does not flame, but rises entirely in thick white fumes, which have the stench of garlic, and cover cold iron, held just over them, with white flowers; white arsenic does the same. 5. I boiled ten grains of this powder in four ounces of clear water, and then passing the decoction through a filter, divided it into five equal parts, which were put into as many glasses. Into one glass, I poured a few drops of spirits of sal ammoniac; into another, some of the lixivium of tartar; into the third, some strong spirit of vitriol; into the fourth, some spirit of salt; and into the last, some syrup of violets. The spirit of sal ammoniac threw down a few particles of pale sediment; the lixivium

of tartar gave a white cloud, which hung a little above the middle of the glass; the spirits of vitriol and salt made a considerable precipitation of a lightish coloured substance, which, in the former, hardened into glittering crystals, sticking to the sides and bottom of the glass; syrup of violets produced a beautiful green tincture. Having washed the saucepan, funnel, and glasses used in the foregoing experiments, very clean, and provided a fresh filtre, I boiled ten grains of white arsenic, bought of Mr. Wilcock, druggist in Reading, in four ounces of clean water, and filtering and dividing it into five equal parts, proceeded with them just as I had done with the former decoction. There was an exact similitude between the experiments made on the two decoctions. They corresponded so nicely on each trial, that I declare I never saw any two things in nature more alike, than the decoction made with the powder found in Mr. Blandy's gruel, and that made with white arsenic. From these experiments, and others which I am ready to produce if desired, I believe that powder to be white arsenic."

Miss Blandy was condemned and executed, denying to the last any knowledge of a noxious quality in the powder she gave to her father.*

The case of Nairn and Ogilvie. Katherine Nairn and Patrick Ogilvie were tried before the high court of justiciary in Scotland, in August, 1765, for incest and murder. Thomas Ogilvie, the husband of one of the parties, and the brother of the other, appears to have been a man in bad health, subject to colics and cough. On the day before he died, he was on foot several miles from his house, and told two or three individuals that he was unwell. He arose, however, on the morning of the 6th of June, somewhat better—walked a mile or two, and on his return, took some tea which had been prepared for him by his wife. Shortly after, he was seized with vo-

* Hargrave's State Trials, vol. 10, p. 1 to 37

miting and purging—complained of great thirst, difficulty of breathing, and pain in the calves of his legs. For about an hour before his death, there was an intermission of the vomiting, but a severe attack then took place, in which he died. This was at night.

Two surgeons and a physician viewed the body *six days* after death. They found the lips, nails, and a part of the breast discoloured, and the tongue swelled beyond its natural size, and cleaving to the roof of the mouth. Dr. Ogilvie thought the body too much putrefied at this time to be opened with safety to the operator; and accordingly no dissection was made. It was inquired of one of the surgeons, whether these appearances might not happen in a bilious colic; to which he replied, that the swelling of the tongue and discoloration of the lips would not.

It was proved that Patrick Ogilvie had shortly before purchased some arsenic.

Both the accused were convicted. Ogilvie was executed, but Katherine Nairn escaped from prison.*

In this case it may be observed, that a negligence almost criminal seems to have attended the investigation; and this is the more astonishing, as apprehensions were entertained of poisoning several days before the death of Ogilve. It is certainly very extraordinary that the poisoned tea was not examined, and it is equally so that the body was not inspected immediately after death.

Case of Miss Burns. I have already noticed this as to the proofs of conception,† and will now consider it with reference to the question of poisoning.

The symptoms. "About six o'clock on Wednesday the 23d of March, 1808, this unfortunate female was seen by the servants in her usual state of health. She was next seen by the servants at about a quarter before nine, sitting at breakfast with Mr. Angus, apparently very ill. After breakfast, she was lying on a sofa, still very bad, and complaining of a pain in

* Hargrave's State Trials, vol. 10, p. 479 to 520.
† See vol. 1, p. 147.

her bowels. On moving about afterwards, she held by the chair, as if from pain ; and about an hour and a half after breakfast, she ordered some water-gruel, of which she drank nearly three quarts in the course of the day. She continued very thirsty, in pain, and sick the whole day, vomiting frequently, and rejecting the gruel almost immediately after taking it. What she vomited, appears to have been of a green colour. On Thursday morning at six o'clock, she was lying, as she had been left the night before, on the sofa, with pillows under her head. She complained that she was very thirsty—said she was tired of gruel, and got some water posset and a little warmed beer. She also complained that she was badly hurt to make water, but was relieved by sitting on an onion sliced, with some boiling water poured upon it. This morning her vomiting was of a black colour, and she continued sick and vomiting all day, till towards evening, when the sickness went off, and she appeared better, and could stir more about.

On Friday morning at four, the house-maid went into the room, and thought her much worse, as she breathed quicker than before. She was again seen about six, in much the same state, and lying in the same posture on the sofa. She asked for some warm beer, which remained on her stomach, and she also got about a pint of gruel. She said that the pain had left her. Her vomiting had ceased, but was succeeded by a *lax*, which continued all the morning. A little before ten, the house-maid was sent out for some madeira, Miss Burns having asked for some. Between ten and eleven, the kitchen-maid was in the room, and received orders about dinner. Miss Burns said she would have some barley-water. On the return of the house-maid, about eleven, she went straight into the parlour, and Miss Burns was found lying dead in the corner by the door, with her face against the wall, cowered of a lump, her elbows upon her knees, and one foot *crudled* under her.

During the whole course of her illness, she did not

go to bed, but remained in the parlour, generally lying on a sofa. She refused to have medical assistance, but Mr. Angus said he gave her seven drops of laudanum one night, and ten drops another, and on the morning of her death, some castor oil in spirits, which came up immediately."

Appearances on dissection. Drs. Rutter and Gerard, with Mr. Hay, a surgeon, examined the body on Sunday, two days after her death. "After having removed the body, a small stain of blood was observed on the sheet of the bed on which it had laid, and the pillow was stained with a fluid which had issued from the head. The body being lain on a table, a large quantity of a thin yellowish fluid poured out from the nostrils, and was collected in vessels. No marks of external violence were discovered on the body, nor was there any appearance of commencing putrefaction. The nails of the fingers were of a bluish colour, and the veins on the external surface of the abdomen appeared to be much enlarged. On opening the abdomen, a considerable quantity of fluid was found to have been effused into that cavity, similar in colour and smell to that which issued from the nostrils, but more turbid. Marks of inflammation were found on the external or peritoneal coat of different portions of the small intestines, but the large intestines were free from it. The external coat of a part of the smaller curvature of the stomach was also inflamed; and a similar appearance of inflammation was observed on a small portion of the anterior edge of the liver, directly over the smaller curvature of the stomach. On raising up the stomach, an opening through its coats, of about the size of a crown piece, was found in the anterior and inferior part of its great curvature; and from this opening, a considerable quantity of a thick fluid, of a dark olive colour, issued, of which fluid some ounces were collected and preserved. The natural structure of the coats of the stomach for a considerable space around this opening, was destroyed, and they were so soft, pulpy and ten-

der, that they tore with the slightest touch. Around this part of the coats of the stomach, there were no traces of inflammation whatever. The stomach was then taken out of the body, and its internal surface was carefully washed, and the contents washed out were preserved. The internal villous coat of the duodenum was slightly inflamed; and a quantity, about three ounces, of a fluid resembling that in the stomach, but not quite so thick, was also taken out of one of the smaller intestines and preserved."

Chemical examination. The assistance of Dr. Bostock was obtained for this investigation. The fluid taken out of the stomach and intestines, and cavity of the abdomen, as well as that collected from the nostrils, were subjected to various tests by that able chemist, but no proof of the presence of arsenic or mercury could be obtained. And the examiner could not discover in the contents of the stomach, by the smell, the presence of any known deleterious vegetable substance. The fluid contained in the stomach deposited no sediment, nor was any but a mucous sediment found in the water with which the inner surface of the stomach was washed.

The contents of the stomach were examined in the state in which they were found, and also after being filtered, but with equally unsatisfactory results.

In consequence of the circumstances attending the death of Miss Burns, Mr. Angus was indicted for her murder, and on the trial Dr. Carson, of Liverpool, appeared as a witness for the prisoner. He objected to the conclusiveness of the proof, both as to symptoms and as to the appearances on dissection.

As to the *symptoms*, he urged that their general mildness showed that she had not been poisoned. This however is merely a gratuitous assertion. Death ensued in this case after an illness of only *fifty hours*—and it certainly requires a full share of hardiness to say that a mild disease would produce this. He also observed, that from all he had read of mineral poisons, he was led to believe that convulsions have al-

ways preceded death. Here he is no less mistaken. Convulsions and delirium, which he afterwards noticed, are both uncommon attendants on the exhibition of this class of poisons.

As to the *appearances on dissection*, he remarked that the bodies of persons killed by poison, run rapidly into putrefaction, and as this did not occur in the present case, so it was a proof in favour of the accused. I have shown in a previous page, from facts quoted in the notice of the trial, and from other sources, that this is a totally incorrect opinion.

The state of the stomach and its erosion, he explained, by referring to Mr. Hunter's paper in the action of the gastric juice. As I have already enlarged on this point, I will not repeat the arguments used, but I may add, that the medical witness for the crown urged against its probability, the fact, that none of the neighboring viscera were acted upon by this fluid. They also suggested that during the illness of Miss Burns, the large quantity of fluid which she drank, and which was immediately rejected by vomiting, must have carried off the gastric juice nearly as fast as it was secreted, and the quantity of fluid found in her stomach must have so diluted and weakened the gastric juice remaining, as to render it unequal to dissolve the stomach itself after death. The injury was not in the lowest and most depending part, but in the anterior part of the large curvature. Lastly, the action of the gastric juice afforded no explanation of the inflammation in the duodenum, small intestines, liver or fundus uteri.

The *chemical proofs* of poisoning were wanting in this case, but the remark of the witnesses on this is founded in truth. "We are not always (say they) to infer that poison has not been administered, because it could not be detected in the contents of the stomach after death."*

* Edinburgh Med. and Surg. Journal, vol. 5, p. 220. Bostock's Vindication, &c.

*The case of Kesler.** Abraham Kesler was tried at the Schoharie oyer and terminer, in the state of New-York, on the 12th September, 1817, for poisoning his wife. The indictment contained two counts, one for administering white arsenic, and the other for administering laudanum. Judge Yates (now governor of this state) presided.

Symptoms. The prisoner and his wife came to the house of Catherine Best, in the town of Middleburgh, on Sunday evening, the 17th of November, 1816. About midnight, the prisoner informed the landlady that his wife was seized with a violent vomiting and purging, but he refused the assistance that was proferred. In the morning, the deceased said she was easier, but complained of pain in her stomach and head, and was extremely thirsty. During the day, she grew worse, with pains in her head and stomach ; she perspired very much, and complained of a burning heat in her breast and stomach. Cold chills also occurred occasionally. On the second morning, she appeared better, but still felt pain, and a burning heat in the stomach. Mrs. Best urged the prisoner to send for a physician, which he declined at first, but after repeated requests, at last said he would go for one. It appears that he purchased some medicines, but never desired the physician to visit his wife. Indeed no medical man saw her until the day before her death. On Tuesday afternoon she was again seized with violent pains and vomiting, and at intervals with cold chills and sweats. The next morning she was better and attempted to sit up, but a trembling in her limbs and drowziness came on, which forced her to return to bed.

On Wednesday afternoon, the prisoner said he had

* I had intended to add the case of *Eliza Fenning* in this place, but on referring to it, I find the proofs of poisoning were completely established, so much so indeed, that the arsenic in powder was picked out of the poisoned dumpling, and a half tea-spoonful of it was taken out of the pan in which they had been kneaded. The question which excited so much agitation in England, was, whether *she had been the poisoner?* I have noticed the symptoms in another place.

given her a vomit—in the evening, all her former symptoms returned with great violence. She said her whole body was in distress and pain, and was alternately cold and hot. Kesler was again urged to go for a physician, which he did, but brought none with him. On Thursday, she was occasionally delirious. Kesler gave her more medicine, upon which she grew still worse. In the evening, Dr. Carpenter saw her, and pronounced her past recovery. On Friday she could not speak, and died on the evening of the same day, (the 22d of November.)

From the evidence of Dr. Carpenter, it appeared that Kesler had called on him several times and purchased a dose of tartar emetic, two portions of cathartic, and three or four fever powders, composed of opium, camphor and tartar emetic. He also obtained from Dr. C. half an ounce of opium, stating that his wife was in the habit of taking opium and could not well do without it. This was afterwards proved to be totally false. Her relatives with whom she had resided (for Kesler enlisted as a soldier immediately after his marriage, and never lived more than four or five months out of five years with his wife) positively swore that they had never known her to take any opium. When Kesler called the second time on the physician, he obtained more opium, alledging that the former had been lost. On the third visit, he purchased a vomit. On Thursday evening, when Dr. C. saw the deceased, she complained of a severe pain in the pit of the stomach, and such soreness about that part, that she could not bear the bed clothes on her. Her extremities were cold, her pulse was fluttering, intermitting and very feeble, and her countenance ghastly.

Appearances on dissection. The body was disinterred two months after death, for the purpose of inspection. Putrefaction was far advanced, and the surface of the body was of a dark colour, particularly on the abdomen. The stomach and intestines were in an highly inflamed state, and on opening the for-

mer viscus, a small quantity of a very dark coloured fluid was observed. Small particles of a vitreous appearance, were also discovered on the inner coat, and some of them had penetrated into it. Finally, opium in considerable quantity was found in the stomach.

The intestines do not appear to have been particularly examined, but it is mentioned that particles of the same nature as those mentioned above, were taken from the smaller ones.

Chemical examination. The particles in question when crushed with a knife, exhibited a white colour. Some of them were thrown on a heated iron, and a dense white fume arose from their combustion, but the witnesses state that they could not detect any peculiar smell. And they account for this from the fact, that tar was kept burning in the room to destroy the smell from the corpse. Dr. Miller and Dr. White at different times placed a portion of these particles* between polished plates of copper, and after securing them with an iron wire, submitted them to a red heat. In both instances, the interior of the plates towards their edges were whitened in a circular form.

Dr. Miller took home about two tea-spoonfulls of the contents of the stomach, which also contained some of the particles, but indisposition prevented him for some time from performing any experiments on it. When he did so, he diluted the contents of the stomach with a pint of water, and being now colourless, he applied Marcet's test in the manner directed by that chemist. An *orange* coloured precipitate fell down, and on repeating the same upon a known solution of arsenic, the same precipitate was observed. Dr. Joseph White also performed this experiment at his residence, but the result in question was not obtained, in consequence of the turbid state of the fluid. As opium had been detected in the stomach by the

* It must be noticed, that the particles *solely* were placed between the copper. No charcoal was added.

smell and the taste, he took a solution of arsenic, and added to it some of the tincture of opium. Marcet's test was then applied, and a precipitate was produced, of the same colour and appearance as that produced on the fluid of the stomach.

Dr. Joseph White also put some of the fluid of the stomach into a phial, containing a solution of the sulphate of copper and sub-carbonate of potash. "This mixture," he testifies, "after standing for some time, produced a copious precipitate; that precipitate, however was darker, and that portion of the fluid above the precipitate was also darker than what takes place in the process for making Scheele's green."

This was the medical testimony. Accessary circumstantial evidence was adduced, and the result of the investigation was a verdict against the prisoner.

Judge Yates transmitted the minutes of the testimony to the executive, (Governor Clinton,) who submitted them to the examination of Dr. M'Neven, professor of chemistry in the New-York School of Medicine. The report of this gentleman, together with a statement from the foreman of the jury, induced the Governor to suspend the execution of Kesler, and to refer the consideration of his case to the legislature, the supreme tribunal, to whom the power of pardoning or punishing would now belong.

Dr. M'Neven barely notices the deposition of Dr. Carpenter, but remarks on the appearances after death, that the advanced state of putrefaction, and the numerous and various causes of inflammation, render any inferences from them inconclusive. "Any conclusion," he remarks, "to be drawn from the appearance of inflammation in this case, must therefore depend for corroboration altogether on other facts."

As to the chemical tests, he observes, that the dense smoke proved nothing. Other mineral substances, as corrosive sublimate, calomel, tartar emetic, when placed on a heated iron, gave out a dense white smoke.

As to the experiment with copper plates, he states

that he put oxide of tin (putty of tin) between two plates of bright copper, and surrounded it with a circle of powdered charcoal. The plates were then brought to a strong red heat, and the consequence was a whitish stain towards the edges of the copper. The same experiment was made with calomel, and there appeared an irregular whitening towards the edges, but less distinctly than in the former case. Dr. M'Neven then made a third experiment with charcoal alone, and having raised the heat pretty high, there was left in the place of the charcoal, a pale brass coloured circumscribed spot, that appeared white in comparison of the red copper colour round it. Rubbing did not at all lessen this whitish stain. "An experienced eye," he remarks, "would perhaps distinguish all these stains from the whitening of arsenic, but in a capital case, I would not like to convict on a shade of colour."

To the value of Marcet's test, he objects, that Dr. Miller should have stated whether well water had been used, as it alone would give a precipitate with nitrate of silver. The colour of the precipitate should have been *yellow* instead of *orange*. And finally, he urges the fact, that phosphoric acid would produce the yellow precipitate.

As to Scheele's green, its inconclusiveness was shown by the following experiment. "I took the expressed juice of onions and added to it a solution of sulphate of copper; immediately the whole was turned to a beautiful green, not to be distinguished in appearance from that of Scheele's green."

In his general remarks on the scientific testimony, Dr. M'Neven offers the following opinion. "Some of the results obtained in the experiments of the physicians, are such as arsenic will afford, but not exclusively; nor can any reliance be placed on any one or all of them, unsupported by others more decisive. I have shown, that the same, or some very similar to them, proceed from other and innocent substances. At the same time, the unerring signs of arsenic were

not had at all; nor were the most proper means taken to procure them.

"The only thing to be relied on, in the opinion of the best chemists, is *the exhibition of the metal itself in its metallic lustre and state.* The arsenic might next be further identified by putting a small quantity between two polished plates of copper, surrounded by powdered charcoal, and exposing them to a low red heat. If the included substance be arsenic, a white stain will be left on the copper. In this way, every part supports another, and there is no possible ambiguity. But as those experiments, which are alone certain, were omitted, and no experiment performed with unexceptionable accuracy, I must (he concludes) give it as my opinion, confining it however to the scientific part of the testimony, that the indictment for poisoning with arsenic is not substantiated by the evidence of the witnesses."

The message of the governor, with its accompanying documents, was referred to a committee of the legislature. These gentlemen proposed questions to several physicians summoned before them, (Drs. Low, Stearns and Bay, and the author of this work,) touching the symptoms, appearances and tests, and at their request also, experiments were instituted by the late Dr. James Low,* with reference to the difficulties proposed by Dr. M'Neven. The answers to the questions admitted among other things, that *all* the tests of arsenic had not been used, and that in particular the reduction of the metal, the most important one, had been omitted. But they stated at the same time, that the experiments generally, indicated the presence of arsenic. They also mentioned, that although other causes might have produced the symptoms in question, yet they were among the usual effects of arsenic, particularly if, as was highly probable, the exhibition of opium had been interposed between its differ-

* A graduate of Edinburgh, and while there the private pupil of the late John Murray, M. D. lecturer on chemistry.

ent administrations. They asserted the improbability of the white particles being the remains of any of the medicines furnished to the prisoner by Dr. Carpenter, and they urged the fact of these particles laying unaltered for two months in the stomach, as a proof that they were of a metallic nature.*

Dr. Low applied Marcet's test to a solution of arsenite of potash and to an infusion of onions. In the one case, the characteristic appearance was produced, but in the other, "there was so slight a variation of colour (if any) that it could not be named, and no precipitate at all." The sulphate of copper was then applied to a solution of white oxide of arsenic and potash, and also to a portion of the infusion of onions. In the former, a bluish green precipitate appeared; in the latter no obvious green colour was present, and no precipitate.

Five grains of oxide of bismuth, with a circle of charcoal, was next placed between two plates of copper, and the same quantity of corrosive sublimate, tartar emetic and arsenic was treated in a similar manner. The eight plates in question were thus submitted to an equal degree of heat. On examination, the bismuth plates exhibited a *slight whitish* spot in the centre of the plates, where the bismuth was in contact. The corrosive sublimate and tartar emetic ones had the copper hue impaired in different places, and in some parts, they were permanently a little whitish, but the arsenic plates presented the unequivocal silver-like alloy.† "I should have no hesitation," he adds "in stating, that these experiments, all of which produced changes on the surface of the copper, decide the question as the appearance of the alloy of copper and arsenic, in which there is, com-

* The answer to one question is doubtless incorrect, and must therefore be noticed. It refers to the rapidity with which arsenic will induce vomiting, and asserts that *a full stomach will probably retard the operation, and an empty one accelerate it.* Renault and others assert that the contrary is the fact, and they substantiate it by cases.

† These plates were afterwards shown to Dr. Joseph White, who stated distinctly, that the appearance found by him perfectly resembled the arsenic plates used by Dr. Low.

paratively, a marked difference of aspect from the other three."

The committee of the legislature presented a statement of these answers and experiments to the legislature; but they stated explicitly, "that they would not, however, direct the execution of the convict upon this testimony alone, and their opinion had been influenced entirely by taking it in connection with the other testimony in the cause." They accordingly brought in an act for the execution of Kesler, which passed both houses of the legislature and the council of revision, (consisting of the governor, chancellor and judges,) and he suffered the punishment prescribed.*

I do not intend to offer many remarks on this case, but I may be permitted to say, that while I deeply regret that the reduction of the metal was not effected, yet the results obtained from the tests used, present to my mind a very strong chain of evidence against the accused. I am acquainted with the fact, that exertions were fruitlessly made to procure the proper apparatus for the reduction, and therefore the invidious sneers that have appeared concerning the ignorance of the witnesses, might well have been spared. But I will not enter into this controversy. Dr. M'Neven viewed the subject as a chemist. I wish to consider it (so far as the distinction is allowable) as a medical jurist, and I present it to those who are desirous of examination, in the following point of view. What substance is there, that will lay undissolved for two months in the stomach of a diseased person, and on proper trials, will give, in a fluid state, a yellow precipitate† with Marcet's test, and although turbid,

* In this narrative, I have endeavoured to present a fair and complete abstract of all the leading facts and reasonings adduced by the various individuals concerned, and I trust that it will be so considered. At all events, I feel a consciousness that there is no intentional perversion or omission in any part of it.

† I use this term advisedly. The characteristic appearance of Marcet's test was unquestionably present, and the use of the term *orange* instead of *yellow*, must not lead us to conjecture a mistake on this point. *The test was applied at the same time to a solution of arsenic*, and the resemblance was perfect.

will present a dark green with Scheele's? These results must be taken *unitedly*, and not *separately*. It is certainly no answer, that the oxide of tin will produce one, and a decoction of onions the other. In order to render them properly available, it should have been proved that they had been administered during the illness of the female. The probability at present is decidedly against it. Scheele's green also is a sufficient preventive of mistake as to phosphoric salts.

Again, are not the symptoms strongly corroborative? The administration of a substance which produced violent vomiting, after she was convalescing, and the repeated exhibition of this article after its attendant train of consequences, with his falsehood respecting the attendance of a physician, certainly indicate a determination to destroy the health, if not the life of the individual What is there in his favour? *Is it to be found in his offers to another female while his wife was living, or in his wishes that she was out of the land of the living, or in his often repeated determinatioas that he would never live with her?** And yet this is a man whose condemnation, according to Dr. Thomas Cooper, is "not creditable either to the chemical knowledge of the physicians whose evidence influenced his condemnation, *or to the jurisprudence of the state which directed his execution.*"† This is the man, of whose trial he has said, "*no*

* Dr. Cooper, in one of his publications, remarks, that it has not been proved that Kesler had any arsenic in his possession. In elucidation of this, I submit the following extracts from a letter dated May 4, 1823, which I received from Henry J Fxey, Esq. late a member of the senate of this state, and resident near the place where Kesler then lived. "Dr. Atwater was the family physician of Mrs. Halcomb, for whom Kesler officiated as bar-tender. The doctor informs me, that while in attendance at court, he called at the county prison to see Kesler. Other persons were also present, and while retiring, the prisoner beckoned to the doctor to come to him. He did so, and while there, was very earnestly solicited to relate what he would testify to, in relation to the arsenic sold by him to the Halcomb family, and particularly whether he could swear that he (Kesler) had purchased it, at the same time observing, "that it was Mrs. Halcomb's boy who purchased it." On the doctor's answering, that he thought it was the little boy that purchased the arsenic, great pleasure was expressed by the prisoner."

† Cooper's Tracts, p. 431.

*lawyer can find any positive, and no chemist any probable proof of guilt."** This is the man on whom he has rung changes in the *Democratic Press*, before the *American Philosophical Society*, and in the *preface and in the appendix of his Tracts on Medical Jurisprudence.* Dr. M'Neven asserted, that the reduction of the metal was alone to be depended on. He said so, and he maintained it manfully. Dr. Cooper came forward as his champion and friend—quotes long extracts from papers familiar to every student in chemistry, and when we were looking for new arguments and new proofs in favour of Dr. M'Neven's assertion, what does he present us with? A NEW TEST—a test, which from its very application, must be productive of uncertainty—a test, which the only experimenter, that has subsequently examined it, finds Protean in its character, and the results concerning which, are diametrically opposite to those stated by Dr. Cooper himself.

It is not for me to vindicate the jurisprudence of this state. I have only to point to the men who were at that time members of the council of revision, and who deliberately sanctioned the execution.†

I will only subjoin to these a case which lately occurred in Germany, and which is peculiarly interesting from the chemical examination that was pursued. I have referred to it at page 230.

"The subject of it was a woman, 32 years of age, and whose husband had of late given strong proofs of his desire to be separated from her. Returning one day from work, she found her husband and children had already dined, a portion consisting of potatoes and beans, being left in the oven for her, and to this she sat down with an appetite, but owing to its very unpleasant taste, compared to high seasoning with pepper, she could not eat much of it. Resuming her work, she was in half an hour attacked with a sense

* Democratic Press, April 14, 1818.

† The members present, (March 27, 1818,) and who voted for his execution, were, DE WITT CLINTON, Governor; JAMES KENT, Chancellor; SMITH THOMPSON, Chief Justice; and AMBROSE SPENCER, Judge.

of burning heat in the throat, and violent pains in her belly, quickly succeeded by urgent thirst, vomiting and diarrhœa. The symptoms increased, and on the second day afterwards, medical assistance was called in by one of the neighbours, but the medicines administered were rejected by vomiting, and on the night of the fifth day the patient expired, having on the day preceding her death, been interrogated and given the most collected answers to the officers of justice. It was ascertained that the husband had bought arsenic a short time previously; and two of the children, who had tasted of their mother's dinner, were attacked with symptoms similar to her's, but recovered. No part of the infected food could be procured, from the husband having carefully thrown it away.—On dissection of the body of the woman, the stomach and intestines were found highly inflamed, and the mucous membrane of these viscera in several places was detached.

"The contents of the stomach, consisting of five ounces of yellowish red fluid, in the sediment of which nothing in the form of powder could be detected, either by the touch or the eye, assisted by a microscope, were first subjected to experiment. Being mixed with 24 ounces of distilled water, the whole was subjected to ebullition for an hour, and then strained, when twelve and a half ounces of fluid were obtained, which was made the subject of the following trials: The colour of a piece of litmus paper was not in the least altered by it. An ounce of it mixed with 20 drops of a solution of ammoniaretted copper, assumed a yellowish green colour, and deposited a slight precipitate of a similar hue, which, when dried and burnt, emitted a slight but very perceptible arsenical smell, like garlic. Another ounce of it, mixed with half an ounce of a solution of sulphuretted hydrogen, became clouded, and soon after deposited a small yellow sediment, which, treated as the preceding, emitted first a sulphurous, and then an arsenical smell. A third ounce being put in a glass vessel, and made to

boil, had as much boiling lime water added to it, when the mixture became milky, and the sediment also in this case gave a smell of garlic when burnt.—(Experiments like the three preceding, were made with a solution of arsenic, two grains to an ounce of boiling distilled water, and afforded similar results, with this difference, that the precipitates were in larger quantities.) A large teaspoonful of the fluid being poured on a red hot plate of copper, after the evaporation of the water, emitted a distinct smell of garlic, and there remained on the copper small white spots surrounded with a black ring, and which spots could only be effaced with difficulty.

"The contents of the small intestines weighing ninety-two drachms, and consisting of a fluid similar to that found in the stomach, mixed with a larger quantity of mucus and a little yellowish excrement, had thirty-two ounces of distilled water mixed with them, and were then exposed to ebullition for an hour and filtered. Owing to the quantity of mucus, it was only at the end of several days that six ounces of filtered liquid were obtained, and what remained on the filter having almost coagulated, no more could be extracted. That which was produced did not, in the slightest degree, redden litmus paper. A portion of it mixed with a solution of ammoniaretted copper, assumed a dark grass-green colour, and deposited a bright green precipitate, which, dried and burnt, emitted the peculiar smell of arsenic. Another portion mixed with a solution of sulphuretted hydrogen, afforded a much larger sediment, than in the same experiment with the fluid obtained from the stomach, and which sediment did not differ in the slightest degree from the colour of one of orpiment standing beside it, and it also gave the smell of garlic when burnt. A third portion of the fluid, made to boil and mixed with boiling lime water, produced a similar, but much more copious deposit than that obtained in the same trial with the first mentioned fluid. A teaspoonful of the fluid poured

on a red hot plate of copper, gave the same results as in the former instance.

"However convincing these proofs were of the presence of arsenic acid in the fluids submitted to experiment, and also of the large quantity of it in that procured from the intestines, still in so important a matter we did not consider them sufficient, and we now proceeded to boil the æsophagus, stomach and intestines, on the plan proposed by Valentine Rose, in order to detect any particles of arsenic that might be engrained in these parts, or enveloped in mucus, and to procure them in a solid form, or as metal. It may be previously remarked, that although it was now eight days since death, and four days since the parts in question had been removed from the body, and though they had not been kept in a cold room, still they did not emit the slightest putrid smell; they were as yet so firm and tough as to prevent their easily being cut with a common scalpel, and a pair of strong scissars was required for this purpose. On the internal coat of the stomach and intestines, something like a powder or crystals could be perceived, either by the touch or microscope. The weight of the whole was forty-four ounces; they were put into the vessel previously used to boil their contents, along with three pounds of distilled water, and six drachms of caustic potass, and the whole boiled for an hour, when the decoction was separated from the solid parts, by means of a hair-sieve. To procure every thing that was soluble, the solid parts were again boiled in a pound of distilled water, and the decoction strained was added to that already obtained. On cooling the decoction, it assumed a dirty, ropy appearance, and several pieces of fat had formed on its surface, which were removed. It was put on a gentle fire and brought to boil, and nitric acid being gradually added to it to saturate the potass, the fluid assumed a clear yellow colour. A considerable quantity of fatty and mucous matter dissolved by the potass, was separted and removed by the filter, a few ounces of distilled water being poured over it to

wash it. It must here be remarked, that when the potass was added, there was merely a soapy smell, but when the nitric acid was poured on, a very disagreeable arsenical smell was emitted. It was now again put on a gentle fire and neutralised with carbonate of potass, but so as to leave the acid slightly predominant, the fluid slightly reddening bitrum paper; for this purpose fourteen drachms of the salt were required. The decoction had now assumed a darker colour, and after some more mucus was separated by filtration, it weighed about fourteen ounces. It was again brought to boil, and mixed with twenty-eight ounces of briskly prepared boiling hot lime water in a glass cylinder. The mixture became instantaneously muddy, and a whitish grey deposit subsided. The cylinder being allowed to remain untouched for a night, in the morning a transparent fluid was poured off, and the sediment being collected on a paper filter, was washed with distilled water and dried. The precipitate when dried, had an ash grey colour, and weighed forty grains; as much pure boracic acid, and ten grains of pure carbon being added to it, they were carefully triturated together, and the whole, weighing ninety grains, were put into a small thin glass retort, provided with a good lute, and exposed to an open charcoal fire till the retort became red hot. When cool, the retort was carefully removed from the furnace, and the lute being removed, it was broken. In the bottom of it was a black loose charcoal mass, consisting of boracic acid and carbon, weighing sixty grains. In the neck of the retort, there was deposited *a real regulus of arsenic in the form of a whitish grey, somewhat granular metallic sublimate.* A piece of fine paper firmly rubbed on this sublimate, had a dark grey spot formed on it, which, smoothed with a polishing iron, assumed a distinctly metallic polish; and on being burnt, gave a strong arsenical smell. Part of the sublimate boiled in a sufficient quantity of distilled water and filtered, (whereby some undissolved greyish particles remained on the

filter) assumed, on the addition of a solution of ammoniaretted copper, a yellowish green colour, and immediately deposited a beautiful yellowish green precipitate, (Scheele's green.) On breaking the retort, the small pieces of glass on which was some of the sublimate, were collected together, and a piece of smooth paper wrapped in it and burnt at the candle, when a strong arsenical smell was produced, so as to oblige us to open the doors and windows.

"The quantity of metallic arsenic contained in the sublimate, may be thus reckoned. During the sublimation, an empyreumatic fluid collected in the receiver, which did not redden bitrum paper, nor did not alter the solution of ammoniaretted copper, and consequently appeared to consist merely of water, which had been united with the powder, at a low temperature. The weight of this fluid was twenty-five grains, and this added to sixty grains of residuum in the retort, makes eighty-five grains. Further, allowing that two grains of the in other respects fire-proof boracic acid, might be mechanically covered up with the moisture, we have remaining at least three grains of metallic arsenic in the sublimate. Seeing that Proust and Rose's manifold and repeated experiments coincide in establishing that in 100 parts of metallic arsenic, there are 333 of arsenic acid, (white arsenic) it follows that three grains of metallic arsenic are four of white arsenic; and it may be with certainty affirmed that these four grains of arsenic acid, actually were present in the viscera examined by us, and were separated by us in a metallic form."*

Antidotes. It will not comport with the object of this work to enlarge much on the present topic, but it is, notwithstanding, proper briefly to notice the most approved mode of treatment.

Our indications are three. 1. To remove the poison. 2. To protect the stomach and intestines

* Quart. Journ. For. Med. and Surg. vol. 2, p. 103, copied from Rust's Medical Magazine, a German periodical work.

from its effects; and 3. If the patient survive long enough, to diminish inflammation.

The first is attempted by means of an emetic, as the sulphate of zinc; but if vomiting be present, we may aid it by dilutents, or a vegetable emetic. Tartrite of antimony should never be given.

But when vomiting does not take place immediately from the means just directed, the urgency of the case warrants us in using more direct remedies. Renault recommends that the stomach be washed and emptied mechanically, by means of a large tube of elastic gum, and a syringe. In this way, a certain quantity of liquid may be thrown in, to dilute or suspend the poison, and by the action of the syringe, the whole may be again withdrawn.* Mr. Jukes, of London, has prepared an apparatus on this principle, which has been applied successfully both to dogs and the human subject.†

The second indication may be effected by means of milk, lime water, soap, drinks sweetened with sugar, or honey. Fat substances, as oil, butter, grease, &c. are considered of doubtful utility, and indeed, according to Renault, they are dangerous. All the animals to whom he gave the arsenious acid, in butter or grease, died sooner than if they had swallowed the poison alone.‖

I place under this class the successful case lately published by Mr. Joseph Hume, where, after the vo-

* Edinburgh Med. and Surg. Journal, vol. 7, p. 91.

† New-York Med. and Phys. Journal, vol. 1, p. 513. It is certainly astonishing that Mr. Jukes should claim this as an invention of his own, since Renault evidently proposed it many years before him. The work of the latter is reviewed in the Edinburgh Medical and Surgical Journal for 1811. But even were not this so, we can still adduce a prior claim to the invention in question, for our own country. Dr. Physick, of Philadelphia, published a paper in 1812, in which he mentions that he *successfully* applied the syringe to a child poisoned with laudanum, and Dr. Dorsey afterwards cured two individuals by the same treatment. That distinguished surgeon, however, subsequently states that Dr. Alexander Munro, Jun. first suggested the invention in 1797, although he (Dr. Physick) was ignorant of this fact when he applied it practically. I conceive Dr. Physick is entitled to the *honour of having been the first who saved life by its means.* See Eclectic Repertory, vol. 3, p. 111 and 381; and American Medical Recorder, vol. 6, p. 294.

‖ Orfila, vol. 1, p. 151.

miting had ended, and retchings and pain remained, he administered the carbonate of magnesia very freely, with tincture of opium, suspended in water. In five days the patient was well. One or two cases have since been published, which evidently increase the character of this remedy.*

3. Dr. Yelloly first suggested the propriety of treating the secondary effects like a case of gastritis, and Dr. Roget adopted it with success. Several cases have since occurred, in which venesection, blisters, &c. were used with the happiest consequences.†

As to antidotes, strictly so called, we unfortunately have none. The *sulphuret of potash* had once a high reputation, but we shall hereafter show that this is itself a poison. Renault tested its efficacy on animals, and found that they died even sooner when this pretended antidote was administered, than when they had taken the arsenious acid solely.‡ *Sulphuretted hydrogen* was rather more successful, but only when the poison was taken in a fluid, and not in a solid form. *Sulphur* has been suggested on the principle of its uniting with the arsenic, but even this has little effect. *Charcoal* has been recommended, in consequence of the experiments of Bertrand, and it would seem to have attained a partial celebrity. The results obtained by Orfila are, however, destructive to its character, and I should consider it very hazardous to depend on this substance.‖

Dr. Chisholm has lately mentioned that the juice of the sugar cane is the best antidote against arsenic. He states that it has been tried upon various animals in the West Indies, with complete success.§

MEDICAL POLICE. A substance so dangerous as ar-

* Journal For. Science, vol. 2, p. 223, from the London Med. and Phys. Journal for Nov. 1821. Quart. Journ. For. Med. and Surg. vol. 5, p. 304.

† See M'Leod, in Edin. Med. and Surg. Jour. vol. 15. Davies, in Lond. Med. and Phys. Jour. vol. 28.

‡ Edin. Med. and Surg. and Surg. Jour. vol. 7, p. 90. Orfila, vol. 1, p 141. ‖ Ibid. vol. 1, p. 500; vol. 2, p. 470.

§ Brande's Journal, vol. 10, p. 193, Edin. Med. and Surg. Journal, vol 4, p. 416. In the latter, cases are related of its efficacy.

senic, should certainly not be exposed for sale in so public a manner as it is at present. Its uses are very confined, and except for one article of medicine, it is not required by the physician. In this country, I am not aware that it is applied in the arts. Why then should every apothecary and druggist be allowed to vend it? Certainly, amid the multiplicity of our laws, an act restricting its sale would be a public blessing.

The king of Prussia is said to have issued some important regulations on this subject in his dominions, but I regret that I have not been able to ascertain the particulars of them.* In France, the sale of arsenic is strictly guarded, and in England, a bill was pending before parliament in 1817, and which doubtless passed, directing all apothecaries and others to affix a printed label, with the word '*poison*,' on every phial, box, or parcel into which they put white arsenic, corrosive sublimate; acetate, carbonate, muriate or nitrate of barytes; oxalic acid, sugar of lead, prussic acid, tartar emetic, solid opium, or laudanum sold by them. All arsenic kept for sale is to be mixed with carbon, and all oxalic acid with rose pink.† Surely some or all of these provisions, might be incorporated with advantage into our code of laws.

I shall notice the remaining compounds of arsenic in as brief a manner as possible, since few of them are ever used as the instruments of murder.

The arsenites. The alkaline arsenites are soluble in water, and act as violent poisons. And among them, that formed with potash deserves particular attention, since it is the substance commonly called *liquor arsenicalis*, or FOWLER'S SOLUTION. It is not necessary to notice its application in medicine, but I may add, that while practitioners in England seem to increase in their partiality for it, and extend its administration to various and opposite diseases, the continental physicians speak discouragingly of its utility. Broussais, in France, declares, "that al-

* Edinburgh Med. and Surg. Journal, vol. 9, p. 351; vol. 13, p. 143
† Eclectic Repertory, vol. 9, p. 561.

most all the patients who have been cured of intermittents by arsenical preparations, have died some months afterwards, either from phthisis pulmonalis, or from chronic inflammation of the mucous membrane of the stomach and intestines."* At all events, there can be no doubt but that it should be used with circumspection, and not until other remedies have failed. It is evidently capable of accumulating in the system, and thus may predispose the patient to serious diseases.†

All the tests already mentioned, act on the arsenites as on the arsenious acid, and the precipitates can be reduced in the same manner. The muriate of platina, however, which does not act on the latter, throws down a yellow precipitate with the arsenite of potash.‡

Arsenic acid is to be considered as a more violent and rapid poison than even arsenious acid. This was abundantly proved by the experiments of Brodie, Jaeger and Campbell. Its action is, however, similar.

The operation of tests is somewhat different. Orfila observes, that sulphuretted hydrogen throws down a whitish and slightly yellow precipitate, but Dr. Gordon found in his experiments, that it had no effect on this acid.‖ Nitrate of silver throws down a *brick-red* precipitate. The sulphate of copper is not disturbed by the arsenic acid, but gives a blue precipitate with the arseniates. This acid may also be reduced with the black flux, as also the *arseniates*.

Sulphurets of arsenic. The native sulphurets (orpiment and realgar) have been administered by Hoffman and Renault, to dogs and other animals, without occasioning the slightest derangement, but when the latter administered the artificial sulphurets,

* Edinburgh Med. and Surg. Journal, vol. 9, p. 351.

† Paris' Pharmacol. p. 209. Dr. Astbury (Edin. Med. and Surg. Journal, vol. 15, p. 415,) relates a case, where the solution of arsenic given as a medicine, produced vomiting, and in process of time, anasarcous swellings of the legs and thighs, and of the penis and scrotum. He supposes that a torpor of the absorbents had been induced by its use. Eruptions, paralysis, and ptyalism have also been witnessed from it.

‡ Orfila, vol. 1, p. 153.

‖ Gordon, p. 37.

even in doses of three or four grains, they produced vomiting, purging, and death, and on dissection, the mucous membrane of the stomach was found inflamed and ulcerated.*

It is an interesting question, why this difference exists. By Thenard it has been suggested, that the artificial sulphurets contain some oxygen, while none is found in the native ones. Analysis has not, however, been able to detect it in the former.

In order to detect the metal, the sulphuret should be dried and heated in a glass tube, with a little caustic potash. Sulphuret of potash is produced, and metallic arsenic sublimes, coating the sides of the tube.†

The *black oxide of arsenic* deserves attention, since it is the basis of the *fly powder*, which is much used in France and Germany to destroy animals, and hence may often be the cause of accidental poisoning. Renault, in his experiments on dogs, found it quickly mortal, and when it had acted sufficiently, it produced in the stomach an exudation of blood, and infiltration of the same between the coats of that viscus, without any trace of erosion.‡ Jaeger witnessed the death of a girl, aged sixteen, who was poisoned by drinking water that had stood on it. She made no complaint of pain, and retained her senses to the last, asking for every thing she wanted. Nine hours after death, the skin exhibited no change, except its paleness and a few blue spots on it. On dissection, a slight spotted redness was found about the cardia—the bottom of the stomach was discoloured, and there was a small brown spot, where the villous coat seemed as if superficially burnt.‖ In several cases quoted by Orfila, the stomach was inflamed, and red spots, with extravasated blood, were present.§

* Orfila, vol. 1, p. 155. Dr. Smith has, however, shown that the *native sulphuret*, when applied to wounds, causes death. Ibid. vol. 2, p. 464.

† Ure *ut antea*.

‡ Edinburgh Med. and Surg. Journal, vol. 7, p. 90.

‖ Edinburgh Med. and Surg. Journal, vol. 7, p. 80.

§ Orfila, vol. 1, p. 160.

Arsenical hydrogen gas. This substance has proved fatal to a distinguished chemist, the late Mr. Gehlen, of Munich. He was distilling a mixture of arsenic in powder and caustic potash, in order to observe the action of the latter on the former. Finding that the combination was taking place very slowly, he applied his nostrils several times to the flask which contained the mixture, in order to ascertain by the odour the state of the mixture. About an hour afterwards, he was seized with uninterrupted vomiting, rigor, and excessive prostration of strength; these symptoms continued for nine days, when he died, although every effort was made for his relief.*

It has been suggested, that this gas, on being inspired, is decomposed in the lungs, the hydrogen uniting with the carbonic acid, while the arsenic is deposited in the bronchiæ.†

Arsenic in its metallic state oxidizes so readily, that it would be extremely hazardous to pronounce it innoxious. Renault has, however, given two drachms of mispickel (an alloy of arsenic and iron) to animals, without any injurious effects. This fact gives us the assurance that the arsenic which is sometimes contained in tin, need not to be feared, as it is in the metallic state.‡

MERCURY.

CORROSIVE SUBLIMATE.

This substance, like arsenic, is poisonous, whether internally or externally exhibited; but a larger quantity is required to produce deleterious effects.

INTERNALLY. *(a) Its exhibition by the mouth.* If corrosive sublimate be exhibited in considerable doses, and especially if its use is too long continued, it causes colic and vomiting. These are succeeded by affections of the salivary glands, ptyalism, swell-

* Male, p. 176.
† London Med. Repos. vol. 4, p. 431. Brande's Journal vol. 3, p. 208.
‡ Edinburgh Med. and Surg. Journal, vol. 7, p. 90.

ing of the tongue and gums, destruction of the teeth, and swelling of the face and head. Cardialgia, diarrhœa, dysentery, phthisis pulmonalis, tremors of the limbs, paralysis, or even death, have been the consequence of persisting in such a course for an improper space of time.*

Dreadful as this catalogue of ills may appear, it is usually aggravated when we are called to view a patient *poisoned* by this mineral. The dose is then larger, and the effects are more immediate. We may state the *ordinary* symptoms in such cases to be the following: "An acrid, astringent, metallic taste in the mouth; a sensation of stricture and burning heat in the throat; anxiety, and rending pains in the stomach, and in the whole of the intestinal canal; nausea, frequent vomiting of a fluid, which is sometimes bloody, and accompanied with violent efforts; diarrhœa, sometimes dysentery; pulse small, tight and frequent; faintness, general debility, difficulty of breathing, cold sweats, cramps in all the limbs, general insensibility, convulsions and death."†

In addition to these, it has been noticed by some observers that there is a great diminution in the secretion of urine. Dr. Henry of Manchester, in a case where death followed in four days, remarked that no urine was voided after the third day, and on introducing the catheter, the bladder was found empty.‡ In the cases related by Mr. Valentine, where a mother poisoned herself, and four children, the same observation was made. One child died in twelve hours after taking the poison, and during this period, no urine was secreted; another in twenty-four hours, and voided a very small quantity. The third died in thirty-one hours and secreted none, while the mother, who lived seventy hours, only passed a very little."‖

* Orfila, vol. 1, p. 47. † Ibid. vol. 1, p. 60.

‡ Edinburgh Med. and Surg. Journal, vol. 7, p. 151.

‖ Edinburgh Med. and Surg. Journal, vol. 14, p. 468. The only one (a child) that recovered, in consequence of having taken a smaller quantity, voided no urine in three days.

It must also be remarked, that the pain and stricture in the pharynx and œsophagus, are sometimes so severe as to cause the greatest distress in swallowing even the mildest fluids, and in one instance, they were so excessive, as for some hours to destroy the power of speech.* Bloody vomiting is not uncommon, and coagulable lymph has been found in the matter purged, mixed with clots of blood.† In fatal cases, the pain at the scrobiculus cordis continues without intermission, and in those who recover, it is among the last symptoms that disappear. In Dr. Henry's patient, a complete paralysis of the upper and lower extremities occurred a few hours before death.

(b) By injection into the anus. We have reason to believe, from the result of experiments on animals, that the effects of the poison administered in this way would be similar to the former. The only case on record, that I have noticed, is a complex one; from the extraordinary combination of poisons given to destroy life. As however, the corrosive sublimate appears to have been the immediate agent of death, I shall mention it in this place.

Sir Thomas Overbury, was poisoned in the year 1613, in the Tower of London, at the instigation of the Earl and Countess of Somerset. The agents were punished, but the principals escaped. From the confession of Franklin the apothecary, it appears, that the Countess wished to procure the strongest possible poisons for Sir Thomas. He accordingly bought seven, *aqua fortis, white arsenic, mercury, powder of diamonds, lapis costitus, great spiders and cantharides.* All these were given at different times. Sir Thomas never eat white salt but there was arsenic put into it, and Mrs. Turner, when two partridges

* Case by Mr. Anderson, Edinburgh Med. and Surg. Journal, vol. 14, p. 474. On the contrary, a case is related by Mr. Saunders, where the patient lived nine days, and during that period experienced little pain, and only felt some soreness after the sixth day. Hiccup was present during part of his illness. London Med. Repository, vol. 2, p. 458.

† Valentini *ut antea.* In two of these cases, coma and insensibility of the pupils were present for some time before death.

were sent to him, and water and onions were the sauce, put in cantharides, instead of pepper. Indeed said Franklin, he seldom eat any thing, in which there was not poison.

Richard Weston, while acting as keeper to Overbury, procured a poison of a green and yellow colour (rosalgar) and mixed it with his broth. He procured white arsenic and mixed it with the food, and in addition, mingled some corrosive sublimate, in tarts and jellies. *The sublimate was also dissolved in a clyster and administered to the prisoner.* This produced, according to the confession of Weston, sixty stools, together with vomiting. Sir Thomas died the next day.*

Externally. *Applied to a wound or ulcer, or to the skin.* Orfila quotes several cases, illustrating the dangerous and indeed fatal effects of this mode of application. I shall only cite one, from Pibrac. "A strong robust woman, aged forty-nine years, of a good temperament, having an ulcerated cancer of the breast, was entrusted to the care of an empiric, who employed upon her, his white powder, externally applied. It was corrosive sublimate. The patient was in great pain after the application; the pains of the cancer greatly increased, and in the space of a few hours became intolerable. A crowd of accidents occurred at once; oppression, nausea, vomitings, which extended even to blood, and convulsive motions the most violent. In fine, she suffered in every part of her body, a dreadful torture, from which she was not delivered till the next morning by a horrible death.†"

A solution of corrosive sublimate in alkohol, applied to the skin, has produced within a few hours, violent pains of the stomach, accompanied with sickness, vomiting, and diarrhea. The debility that follows is of the most alarming kind. In one instance, the stools consisted of blood and mucus, and it is evident, that if the use of this noxious substance had

* Hargrave's State Trials, vol. 1, p. 323, 345
† Orfila, vol. 1, p. 59.

been continued, fatal consequences would have ensued. Salivation seems to be a constant effect from this mode of application.*

Appearances on dissection. After an examination of the experiments that have been made on animals as well as of cases of poisoning, Orfila comes to the conclusion, that it is impossible in the present state of science to point out with precision, "the seat, extent and character of the lesion produced by corrosive sublimate," and the main argument in favour of this opinion seems to be the fact, that similar effects are produced by other corrosive poisons. But although this may be allowed as a correct position, yet it is still necessary to point out the appearances that have been noticed. If they are common to other substances, we shall only have the disadvantage of repetition.

I shall merely notice the results ascertained in individual cases. Foderè mentions some dissections, in which various parts of the stomach and intestines were found inflamed or gangrenous. In one instance, the villous coat of the stomach was destroyed.†

In the case of Dr. Henry, already quoted, the external appearance of the stomach and intestines was perfectly natural. About two ounces of a thick yellowish ropy fluid were found in the stomach, which was but moderately distended with air. On its inner surface, numerous dark red spots, indicating inflammation of the villous coat, were observable. They extended through the whole length of the smaller curvature and occupied the greater part of the fundus, but did not appear in the lower portion of the large curvature. No abrasion of the villous coat was perceptible. The inner coat of the duodenum, as far

* Cases of this nature are related by Dr. Anderson (Edin. Med. and Surg. Journal, vol. 7, p. 437,) and Mr. Robertson (ditto, vol. 8, p. 195,) and by Dr. Cloquet of himself, communicated to Orfila, (vol. 2, p, 462.) In this latter, vomiting, gripings and tenesmus were induced, barely from plunging his hands several times in a concentrated solution, for the purpose of taking out some anatomical preparations, and neglecting afterwards to wash them.

† Foderè, vol. 4, p. 151

as the middle of its length, presented the same appearance of inflammation. The lower part of the œsophagus, for about three inches above the cardia, was slightly inflamed, but higher up, it was of a natural colour. The heart, lungs, liver, and spleen were sound. The gall-bladder was emptier than usual. The left kidney was of a looser texture than natural, and a small abscess was discovered in it, filled with pus. *The bladder was empty and exceedingly contracted.*

In each of the four cases, of Mr. Valentine, he found the stomach greatly diseased. Black circular patches, about three inches in diameter, were observed, and from them an extensive inflammation of the inner coat diverged in all directions. "In the child which died first, the texture was totally destroyed through all the coats, as far as the circular patch extended, and on washing off the destroyed parts, only the peritoneal covering of that part of the organ was left. It cannot be better compared," he observes, "than to a piece of leather *burnt with a red hot coal.*" The intestines were highly inflamed. The gall-bladder in every case was greatly distended with bile. The peritoneum generally inflamed, as were also the mesentery and omentum. In one instance, the kidneys were inflamed. *In all, the urinary bladder was much contracted; in the mother, it was of the size of a walnut, and in one of the children, no larger than a marble.*

The bodies externally were of a crimson colour, posteriorly, on the shoulders, back and hips.

In the case related by Mr. Saunders, the stomach generally was inflamed, and its cavity was lined with a considerable quantity of viscid and glutinous mucus, but there was nothing like corrosion or sphacelus. The liver, spleen and other viscera were not unhealthy.*

Effect on animals. The experiments of Mr. Bro-

* London Med. Repositoy, vol. 2, p. 458.

die are among the most satisfactory of any that have been made, and they correspond in most particulars with the results observed on the human subject.

He injected into the stomach of a rabbit, by means of an elastic gum tube, six grains of corrosive sublimate, dissolved in six drachms of distilled water. No immediate symptoms followed the injection; the animal made no expression of pain, but in three minutes he became insensible, was convulsed, and in four minutes and a half from the time of the injection being made, he died. On opening the thorax, the heart was found to have entirely ceased acting, and the blood in the cavities of the left side was of a scarlet colour. The stomach was much distended. The pyloric and cardiac portions were seperated from each other by a strong muscular contraction, which appeared to have prevented the passage of the fluid from the upper to the lower part, since the contents of the pyloric portion were firm and solid, and in every respect resembled the usual contents of the stomach, while those of the cardiac portion consisted of the food of the animal much diluted with fluid. In the pyloric portion also, the mucous membrane had its natural appearance, but in the cardiac portion, it was of a dark grey colour, readily torn and peeled off, and in some parts its texture was completely destroyed, so that it appeared like a pulp, on removing which, the muscular and peritoneal parts were exposed. A similar experiment, with a scruple of corrosive sublimate, on a cat, produced death in twenty-five minutes, and on dissection, the texture of the stomach was found destroyed as in the preceding case, the mucuous coat tore and separated from the muscular with great facility, and the upper part of the duodenum was similarly altered, although not in so marked a manner.

The same experiments were now performed on a dead rabbit and cat, and *precisely the same appearances were found on dissection*, except that as the

middle contraction was wanting, the disorganization was not confined to the cardiac portion.

The conclusion drawn hy Mr. Brodie is the following: "Corrosive sublimate, when taken internally in large quantities, occasions death by acting chemically on the mucous membrane of the stomach, so as to destroy its texture; the organs more immediately necessary to life being affected in consequence of their sympathy with the stomach."* He also denies the idea of the absorption of the poison in these cases. This, however, is believed by many physiologists, and at all events is far from being a settled question.†

Corrosive sublimate has been considered as nearly innoxious to horses, and has been given in doses of several drachms without producing any apparent effects. An instance is however related by Dr. Reeve, where two ounces produced death in eight hours, and previous to this, there was a copious discharge of urine and fœces. On dissection no inflammation was observed in the coats of the stomach; the intestines however, were flabby and tender, and putridity had far advanced in them. The liver and kidnies were in a putrid state.‡

In several experiments made by Dr. Bostock and others on dogs, with small doses of this mineral, vomiting and purging, with symptoms of violent pain, ensued, and after some hours they terminated in death. In one case on dissection, the peritoneal coat of the stomach was found inflamed, and the vessels of its internal surface were injected, so as to present a general redness; but there was a very slight corrugation of the coats, and no erosion; but in another instance, where the dose had been larger, the villous coat was much corrugated and inflamed, and on that part of it which lines the small curvature, there was much blackness, which had the appearance of blood extravasated between the coats. On cutting however

* Edinburgh Med. and Surg. Journal, vol. 7, p. 462.
† See Edinburgh Med. and Surg. Journal, vol. 11, p. 126.
‡ Ibid. vol. 6. p. 254.

through the villous coat, there was no extravasation.* The quantity in these and similar cases will doubtless produce a variety in the appearances.

Chemical proofs. There is some difference among chemists, as to the precise solubility of corrosive sublimate; but we shall probably be correct in stating, that from sixteen to twenty parts of distilled water will dissolve one part. And this fact should be remembered, as it will prevent an unnecessary addition of fluid.

The tests suggested for the detection of this mineral are numerous, some being applicable to the suspected substance, when in a solid, and others when in a fluid state.

(a) If a powder is collected, and is supposed to be corrosive sublimate, add charcoal and a little water to it, and thus make a paste. If this be submitted to the action of heat, in a close vessel, metallic mercury is obtained from the decomposition of the salt.

(b) If corrosive sublimate be let fall in minute fragments into a tube of glass, the bottom of which contains a little pure caustic potash, melted by heat, one portion of the salt rises in the form of smoke to condense itself on the sides of the tube; while another portion sinks down and takes a red colour. If the heat be continued for five or six minutes, metallic mercury, in the form of globules, is obtained, adhering to the sides of the tube, and mixed with the corrosive sublimate that is not decomposed. If the quantity be small and difficult of detection, dissolve the remainder of the salt, and the globules will be precipitated.

(*c*) Expose a small quantity of the powder without any admixture, to heat, in a coated tube, corrosive sublimate will be ascertained by its rising to the top of the tube, lining the inner surface in the form of a shining white crust, and with its peculiar crystalline form. These last, if necessary, should be examined with the microscope.

* Bostock's Vindication, p. 28

(d) If this sublimate be thrown on burning coals, it immediately volatilizes, giving out a thick white smoke, and a pungent smell, not at all resembling garlic, and which when inhaled, often produces irritation and coughing. If a plate of perfectly clean copper, be exposed to this smoke, it becomes tarnished, and receives, by a slight friction, that white and glittering colour which characterises mercury.

(e) The solution of corrosive sublimate reddens litmus paper, but changes syrup of violets to a green.

(f) Lime water in small quantity precipitates the solution, of an orange yellow colour, but if increased, the precipitate becomes red. In still greater quantity, "the precipitate is transformed into an oxide at maximum of a beautiful yellow."

(g) A solution of saturated carbonate of potash (salt of tartar) produces a deep brick coloured precipitate.* Carbonate of soda has the same effect.

(h) The caustic alcoholished potash, poured in small quantity on a saturated solution, forms a yellowish red precipitate, but if on the contrary the potash in excess be poured on it, the precipitate will be a beautiful yellow. The precipitate, both in this experiment and in experiment *g*, on being dried and exposed to heat in a glass tube, will give out metallic mercury.

If, however, the solution of corrosive sublimate is very much diluted, the caustic potash will throw down a white precipitate.

(i) A solution of pure ammonia produces a permanent white precipitate. On the application of heat, it becomes yellow.

(k) The hydrosulphuret of ammonia, in small quantity, gives a dark precipitate mixed with grey and white, but a larger quantity produces a black one.

* Dr. Henry states, that a white precipitate is produced by the addition of a single drop of the solution in question. Orfila denies this, observing that "the precipitate never begins by appearing white, at least if the solution of the sublimate be considerably diluted." Dr. Henry, however, adds at the same time, that if an additional quantity of alkali be applied, an orange coloured sediment will be produced. (Henry, vol. 2, p. 274. Orfila, vol. 1, p. 30.)

Sulphuretted hydrogen and sulphuretted water, also throw down a similar precipitate. This is so minute a test, that Professor Pfaff, of Kiel, is said to have discovered the presence of corrosive sublimate, though diluted with forty thousand times its bulk of water.*

(l) Nitrate of silver throws down the white curdy precipitate, characteristic of muriatic acid.

(m) The muriate of tin gives a white precipitate with corrosive sublimate. This is also an extremely minute test. Dr. Bostock says, that two drops of the muriate, added to a solution which contained $\frac{1}{30,000}$ of its weight of the sublimate, caused an obvious precipitate. When diluted so that the fluid held only $\frac{1}{3,000,000}$ of its weight of the salt, two drops produced an immediate grey cloud, but no precipitate was thrown down.†

(n) The triple prussiate of potash, gives a white precipitate, which in a short time becomes yellow, and afterwards passes into a clear Prussian blue. All these changes of colour are generally produced within thirty-six hours.

(o) If a perfectly clean plate of copper be plunged into a solution of corrosive sublimate, and left there for an hour or two, it will become tarnished, but on rubbing it with a piece of paper, it assumes a white, shining and silvery appearance, owing to a coating of metallic mercury. The same effect will be produced if the corrosive sublimate be dropped on it, or if any of the precipitates obtained in experiments *f*, *g*, *h*, *i*, and *n*, be rubbed over it. This effect is now explained as a galvanic action, and a piece of gold clasped by a zinc wire and immersed in the sublimate solution, was obviously whitened in an hour, although the solution in question only contained $\frac{1}{250,000}$ of its weight of the salt.‡

(p) Mr. Sylvester has proposed another ingenious application of galvanic electricity. "A piece of zinc

* Annals, vol. 5, p. 22.

† Edin. Med. and Surg. Journal, vol. 5, p. 14.

‡ Bostock, Edin. Med. and Surg. Journal, vol. 5, p. 14. The above tests are all taken from Orfila and Henry.

or iron wire, about three inches in length, is to be twice bent at right angles, so as to resemble the Greek letter π. the two legs of this figure should be distant about the diameter of a common gold wedding ring from each other, and the two ends of the bent wire must afterwards be tied to a ring of this description. Let a plate of glass, not less than three inches square, be laid as nearly horizontal as possible, and on one side drop some sulphuric acid diluted with about six times its weight of water. till it spreads to the size of a half penny. At a little distance from this, towards the other side, next drop some of the solution supposed to contain corrosive sublimate, till the edges of the two liquids join together; and let the wire and ring, prepared as above, be laid in such a way that the wire may touch the acid, while the gold ring is in contact with the suspected liquid. If the minutest quantity of corrosive sublimate be present, the ring in a few minutes will be covered with mercury on the part which touched the fluid."*

(q) Brugnatelli has proposed the following method: "Take a quantity of fresh wheat-starch mixed with water, and add a sufficient quantity of iodine to give the liquid a blue colour; if corrosive sublimate be added to this liquor, the colour is destroyed and it becomes reddish, and sulphuric acid will not restore it, as is the case when arsenic is added."†

The next point of importance is, whether any substances which by possibility may be present in the stomach, or any of the human fluids, will change the nature of the substance, or will alter the operation of the above tests? Orfila has made this the subject of notice.

Corrosive sublimate, according to him, is decomposed sooner or later, and converted into the sub-muriate, by most vegetable substances, distilled waters, extracts, oils, syrups, honey, and gums. Muriatic

* Eclectic Repository, vol. 4, p. 452, from Nicholson's Journal, No. 154.
† Annals, vol. 10, p. 151.

acid gas is set at liberty, and calomel will be precipitated, with a portion of the vegetable matter which has undergone some change. A decoction of tea throws down instantly a yellowish grey precipitate in flakes, which becomes pulverulent, and of a violet colour by desiccation, while at the same time, if the water be much loaded with sugar, no alteration takes place till after several days; and alcohol produces no effect for the space of three or four months. The action of albumen on a solution of corrosive sublimate, deserves particular notice. If a considerable quantity of the latter is poured on the former, a white flaky precipitate is formed, which, on being dried, is brittle, semi-transparent, of a yellowish colour, and insoluble in water. On being submitted to heat in a glass tube, the products are principally charcoal, metallic mercury volatilized and adhering to the sides of the tube, and muriatic acid. Small quantities of corrosive sublimate produce milkiness, and the slow deposition of a precipitate. Gelatine causes similar change and decomposition, as albumen. Osmazome gives a reddish yellow precipitate, and bile a yellow one, inclining to red. A concentrated solution of corrosive sublimate brought in contact with a large quantity of milk, produced no visible change, but when seven parts of the solution and one of milk were united, a white coagulum instantly formed, which collected together, and over it floated a liquor extremely clear. Ordinary soup mixed with it in the proportion of one to six, produced a white precipitate. Fibrin or flesh, on being immersed in a solution of corrosive sublimate, loses its solidity, and becomes friable.

It appears thus, that many common substances will decompose the corrosive sublimate, and convert it into the sub-muriate.

The following is the result of the application of tests to some mixtures:*

* Orfila, vol. 1, p. 37 to 46.

Substances employed.	Corr. sub. xij. gr. in water, Burgundy wine 6 oz.	Corr. sub. sol. 1 dr. Milk 14 dr.	Ordinary soup, with a small quant. sol. corr. sub	Bile 1 dr. corr. sub. 1 gr. dissolved in 1 oz. water.
Effect of these mixtures on each other.	No effect.	Sky-blue colour.	Slightly turbid, no precip.	
Tests. Potash.	Black precip.	Yellow.	White or grey precip.	No precip.
Ammonia.	Deep green.	——	Same as corr. sub. alone.	No precip.
Prussiate of potash.	White, going to violet.	Passing to blue.	Same as corr. sub. alone.	
Syrup of violets.	Red.	Blackish grey.	Same as corr. sub. alone.	
Hydro-sulphurets.	Same as corr. sub. alone.	Black.	Same as corr. sub. alone.	A precip.
Plate of copper.	Same as corr. sub. alone.	Same as corr. sub. alone.	Same as corr. sub. alone.	
Nitrate of silver.		——	Same as corr. sub. alone.	
Lime-water.			Dirty white precip.	A precip.

The practical advice to be drawn from these results is, the importance of depending upon the reduction of the metal, as the only infallible proof. If the suspected substance be in a fluid state, the tests as previously mentioned, should be applied, and the precipitates should then be dried, evaporated and reduced. Orfila recommends that a small portion of potash be added to the solution, as this will prevent the volatilization of a portion of the sublimate. Let this be evaporated to dryness, then detach the dry

residue and put it in a small glass tube as already described and gradually heat to redness. Metallic mercury in globules will be quickly obtained. *

The same process is proper when the suspected substance is in a state of solidity. Potash should also be added when the reduction is attempted. But if the quantity of the salt is extremely small, it will be better first to make a solution of the whole and then proceed as before.† But it is possible that the corrosive sublimate may have been decomposed in the stomach, and the submuriate or calomel alone remains. How are we then to act?

Two of the most striking characteristics of calomel are, its insolubility in water and the black colour which it contracts from the addition of lime water. Orfila has however found, that the decomposed precipitate obtained from mixtures of corrosive sublimate with bread, boiled beans and soup, underwent no change, although it lay in lime water for twenty-four hours. In another instance, a paste made of whites of eggs, meat, soup, roasted apples, tea, sugar and sublimate, furnished a greyish white substance which was carefully washed, and lime water though left on it for forty-eight hours, produced only a slight change of colour, causing it to become somewhat deeper. Corrosive sublimate, it thus appears, forms so strong a union with alimentary substances, that lime water cannot decompose it. It only remains to add potash to the precipitate, introduce the mixture into a glass tube and apply heat. Mercurial globules will be produced from the process.‡

* When corrosive sublimate is mixed with wine, or any other coloured fluid, Orfila proposes that sulphuric ether be added to the solution in a phial, and the contents slowly agitated. The ether will abstract the greater part of the sublimate from the water, as there is a greater affinity between the former and the sublimate, than between the sublimate and the water. The strata must be allowed to separate, and the upper one, (being the ether) should then be poured off. Evaporate the fluid and the sublimate remains in a pure and solid state. Quarterly Journal Foreign Med. and Surg. vol. 3, p. 246.

† Orfila, vol. 1, p. 64,65.

‡ Ibid. vol. 1. p. 69, 70.

But it may be asked, whether a salt so soluble and so easily decomposed, is always to be found, either in a solid or fluid state in the stomach or intestines? Or in other words, can an individual be destroyed by this poison, and yet the nicest tests not be able to detect any portion of it after death? The results of modern investigation are decidedly in favor of the affirmative of this question. In the experiments of Dr. Bostock on dogs, the very tests which proved the presence of corrosive sublimate in the most minute quantity, were unable to shew its presence in the fluids of the animals which he had previously poisoned with this very substance, and they only indicated the existence of muriatic acid.* Dr. Henry and Dr. Roget examined the fluid vomited by a female who had poisoned herself, with all the tests mentioned in the chemical work of the former, but neither in this liquid, nor in that found in the stomach after death, were any traces of the poison discoverable.† "In vain, (says Orfila) should we seek, in the general way, for corrosive sublimate in the liquids vomited; neither are the contents of the stomach more calculated to discover its presence. The decomposition which it has undergone by its union with other substances, has rendered it insoluble. *It is in the solids, in the tissue itself of our organs, that it must be sought for.*" In confirmation of the latter remark, he mentions a case, in which he took a portion of the intestines of a cock, and put it in a solution of corrosive sublimate for three days. It was then boiled, then dried in a capsule of porcelain, and finally calcined in a retort. Globules of mercury were soon seen condensed in its neck. The stomach of a dead rabbit, into which a solution of corrosive sublimate had been injected, was treated in the same way, with a similar result.‡

* Edinburgh Med. and Surg. Journ. vol. 5, p. 16.

† Edinburgh Med. and Surg. Journ. vol. 7, p. 150.

‡ Orfila, vol. 1, p. 73. "Il est extraordinairement rare qu'il se recontre assez de cette substance pour la soumettre aux recherches chymiques." Metzger, p. 396.

I am not aware of any trials for poisoning with corrosive sublimate, of great interest, beyond those already noticed. There is a case mentioned in the Edin. Med. and Surg. Journal, where the mineral was mixed with some dumplings, for the purpose of murder, and in them it was readily discovered by Professor Wollaston of Cambridge.*

Antidotes. Alkaline salts and earths were formerly in high repute, as antidotes against corrosive sublimate, and cases are to be found in medical journals where they would seem to have cured the sufferers.† They have also failed, and the same remark will apply to the sulphurets, the infusion of Peruvian bark, and sugar.

We are therefore infinitely indebted to Orfila for introducing ALBUMEN as an antidote to this substance. If taken in sufficient quantity, it decomposes the metallic salt, forming a triple compound, consisting of albumen, muriatic acid, and calomel. Our author proved its efficacy in several experiments on animals. "It has the advantage of being always at hand, and there is no danger of giving it to excess. The practical rule, therefore, is, that as soon as we are called to a person suspected of having taken corrosive subli-

* Trial of Michael Whiting for administering poison to George and Joseph Langman, at the assizes, holden at Ely, in 1812. Edin. Med. and Surg. Journal, vol. 8, p. 348. Dr. Smith, in his work, refers to the trial of Miss Butterfield for poisoning Mr. Scawen, which I have not been able to obtain. He observes, that in this case, the question was somewhat agitated, whether salivation excited by mercury is ever renewed, after having once ceased, without the administration of the mineral being repeated. Such an instance occurred to Dr. Male, and he adds the following on his own authority: "Dr. Hamilton, professor of midwifery in the university of Edinburgh, related a case in his lectures, of a married lady, who had been under the necessity of going through a course of mercury, in consequence of her husband's imprudence, under the care of the late Mr. Bennet. This gentleman, from motives of delicacy, did not enquire very minutely into the particulars, but according to the rule of the day, gave his patient a sore mouth. Four months afterwards, she miscarried, and salivation again came on. It was removed for a week, at the end of which it returned, and harassed her for about a twelvemonth." Smith, p. 114.

† See a case in the Edin. Med. Essays, vol. 6, p. 432, from the *Commerc. Norimb*, 1735, where the *Ol. tartar per deliquium*, and mild drinks, appear to have been the principal agents in effecting a cure. The salt of tartar and salt of wormwood, have each been recommended. Med. Commentaries, vol. 6, p. 324, 415.

mate, we should make him swallow as many whites of eggs, well mixed with water, as the stomach can contain. It will immediately decompose the metallic salt remaining in the stomach, and if it excite fresh vomiting, so much the better. Along with this, blood letting may be had recourse to, in order to overcome the inflammation already excited."* Mucilaginous drinks are also very useful as accessary remedies.†

Dr. Taddei, of Italy, has lately recommended wheat flour, or gluten, as an antidote. He was led to this, from ascertaining that it reduced corrosive sublimate to the state of calomel, and that considerable quantities of a mixture of flour or gluten with corrosive sublimate, might be taken by animals without any injurious effects. In this way, fourteen grains of sublimate were given in less than twelve hours to rabbits and poultry without injury, whereas a single grain would have been fatal if taken alone. Twenty-five grains of fresh, or thirteen of dry gluten, or from five to six hundred grains of wheaten flour, are necessary to render a grain of corrosive sublimate innocent, and Dr. Taddei recommends that dried gluten be kept for the purpose in question in apothecaries' shops. When administered, it is only necessary to mix it with a little water.‡

THE RED PRECIPITATE AND THE RED OXIDE OF MERCURY. These substances, in considerable quantities, are violent poisons. Ploucquet mentions a case of an individual, who, by accident, swallowed some red precipitate. He immediately experienced violent colics, copious vomitings, a trembling in all his limbs, and cold sweats.

* Edin. Med. and Surg. Journal, vol. 11, p. 132. Dr. Peschier of Geneva, has ascertained that it requires an ounce of whites of eggs, to neutralize four grains of corrosive sublimate, taken as a poison. London Med. Repository, vol. 6, p. 167.

† A case in which the whites of eggs were given with perfect success, is related by Dr. Lendrick, in the transactions of the college of physicians of Dublin. London Med. Repository, vol. 15, p. 495. See also another case in Ibid, vol 13, p. 480.

‡ Edin. Philos. Jour. vol. 3, p. 406.

On being heated in a glass tube, they become decomposed, and give out volatile metallic mercury, and on being applied to a clean plate of copper, they silver it. The hydro-sulphurets also blacken them.*

It is not necessary to notice the other preparations of mercury in detail, since their effects, in large quantities, and their modes of detection, are similar to those already mentioned. And I will only allude to the numerous cases which of late years have been described under the names of *hydrargyria, mercurial erithrismus,* &c. as proving that the mildest preparations of mercury, may, under certain circumstances, and in peculiar constitutions, prove highly dangerous, and even fatal.

Mercurial vapours, *and mercury in a state of extreme division.* Mercurial vapours are undoubtedly to be deemed poisonous. Many cases are on record, which prove that workmen employed in mercurial mines, gilders, silverers of looking glasses, &c. are subject to serious accidents from their callings. This however is a point, which I shall notice at length in another place, when treating of the *diseases incident to peculiar trades and professions.*

The usual consequences of a long exposure to them, are "trembling and paralysis of the limbs, vertigo, loss of memory and of the other intellectual faculties, salivation and ulceration of the mouth; colic, asphyxia, asthma, hæmoptisis, atrophy, apoplexy and death."

The following is a remarkable illustration of the effects of mercury, in a volatilized state, on the human system. A large quantity of quicksilver (about thirty tons) was saved from the wreck of a Spanish ship about Cadiz, by the Triumph man of war and the Phipps schooner, both English vessels. It was placed in their spirit rooms. An alarming illness soon broke out among the crews, all of whom were more or less salivated. The surgeons, pursers and three

* Orfila, vol. 1, p. 90, 91.

petty officers who were nearest the place where it was stowed, felt its effects the most, as their heads and tongues were swelled to the most alarming degree. Every rat, mouse and cockroach on board the Phipps were destroyed. And it was noticed, that those who slept close to where the quicksilver had flowed in consequence of escaping from the bags, suffered slightly, in comparison to those who slept over the bags. Every thing metallic was whitened.

The explanation of this distressing event is not difficult. The quicksilver had lain for some time in salt water, and when on board, the leather bags containing it, rotted. Add to these, the effects of gases generated on board ships, and we have sufficient agents at hand to cause the rise, suspension and oxidation of the metal. Dr. George Pearson suggested that sulphuretted hydrogen was probably the principal cause.*

Whether metallic mercury should be deemed a poison, is another question concerning which there is some diversity of opinion. We know that it has often been exhibited in large doses with salutary effects, and indeed in the days of Dr. Dover, two or three drachms of it were a common morning draught, as a preservative against gout and gravel. I apprehend that the proper distinction to be taken respecting it is, that when it can be so acted on, as to be oxidated, even in the smallest degree, (as for example, mixed with fat or oil, or even by friction alone,) it *may* prove deleterious. Mr. Faraday has also contributed a valuable fact in illustration of this subject. He put some mercury in a clean dry bottle of about six ounces, which formed a stratum at the bottom, not one-eighth of an inch in thickness. A small piece of leaf-gold was fastened to the under part of the stopper of the bottle, so that when the stopper was put into its place, the leaf-gold was inclosed in the bottle. It was then set aside in a safe place, and after some time, the

* Edinburgh Med. and Surg. Journal, vol. 6, p. 513. London Med. and Phys. Journal, vol. 26, p. 29.

leaf-gold was found, on examination, whitened by the mercury. He repeated this experiment several times with similar results, and he deduces from it the conclusion, *that at common temperatures, mercury is surrounded by an atmosphere of the same substance.**

* Brande's Journal, vol. 10, p. 354. This deduction will probably explain the following remarks of Dr Falconer, of Bath. "Instances (he remarks) of the ill effects even of the external application of mercury, are sometimes found in the use of what are called quicksilver girdles, which are often worn for the itch, especially by females of the lower rank, as being cleanlier and more free from fœtor than a sulphureous application. Many of these cases have been admitted into the Bath Hospital. The general symptoms were a degree of general weakness approaching to palsy, great pain and tremor in the limbs, and often violent headache." (Edin. Med. and Surg. Journal, vol 8, p. 214, quoted from Trans. Med. Soc. of London

CHAPTER V.

MINERAL POISONS (CONTINUED.)

ANTIMONY. *Tartar emetic.* Symptoms—appearances on dissection—effect on animals—chemical proofs—antidotes. *Oxide and glass of antimony. Muriate and sub-muriate. Antimonial wine. Antimonial vapours.* COPPER. *Metallic copper*—its ready oxidation. *Oxide and carbonate. Verdigris.* Symptoms—appearances on dissection—effect on animals—chemical proofs—antidotes. ZINC. *Sulphate.* Symptoms—chemical proofs—Whether metallic zinc is a safe substance for domestic utensils. TIN. *Muriate*—effects—tests—antidotes. SILVER. *Nitrate*—effects—tests—antidotes. *Fulminating silver.* GOLD. *Nitro-muriate*—tests. *Fulminating gold.* PLATINA. *Nitro-muriate.* BISMUTH. *Nitrate*—tests—antidotes. IRON. *Sulphate.* LEAD. *Acetate.* Symptoms—effects on animals. *Cerusse.* Water impregnated with lead. *Litharge.* Articles of food or drink contaminated with lead. Earthen vessels glazed with lead—action of vinegar, apples, milk, on them. Adulteration of wines—cider—rum. *Saturnine emanations.* Symptoms—chemical proofs—wine test—antidotes. PHOSPHORUS. Effects. IODINE. Effects. THE CONCENTRATED ACIDS. *Sulphuric.* Symptoms—appearances on dissection—chemical proofs—treatment. *Nitric.* Arrangement by Tartra, of poisoning by it, into four classes. Symptoms—appearances on dissection—chemical proofs—treatment. CAUSTIC AND CARBONATED ALKALIES. *Potash. Sub-carbonate of potash.* Symptoms—appearances on dissection. *Soda. Ammonia.* BARYTES AND ITS SALTS. Effects on animals—symptoms—chemical proofs—antidotes. QUICKLIME. LIVER OF SULPHUR. Effects—appearances on dissection—treatment. NITRE. Symptoms—appearances on dissection—treatment. SAL AMMONIAC. GASES. *Chlorine*, gaseous and fluid. *Nitrous acid gas. Sulphurous acid gas. Nitrogen. Carbonic oxide.* GLASS AND ENAMEL? Remarkable medico-legal case. General directions for ascertaining the nature of a suspected mineral substance by chemical tests—soluble substances—insoluble substances. Laws on poisoning, when death does not immediately follow.

ANTIMONY.

A great prejudice formerly existed against the use of metallic preparations, with the exception of iron, and this was carried to such a height as to the compounds of antimony, that the faculty of Paris (among whom Guy Patin was the most conspicuous) obtained

an edict of the parliament of Paris, prohibiting their use as a medicine. Nor was it until one of their sovereigns had been cured by the use of antimony, that they (in 1666) demanded a sentence permitting its use.* It is to be feared, however, that the various preparations are often rashly and improperly employed at the present day.

Tartar emetic. This substance in large doses must undoubtedly be deemed a poison. It is, however, far from being as certainly destructive as arsenic or corrosive sublimate.†

The narrative of a few cases will properly precede the list of general symptoms.

A Jew, by mistake, took about twenty grains of tartar emetic in the morning, fasting. In a few moments after swallowing it, he experienced pain in the region of the stomach, which increased, and even brought on syncope. After this, excessive vomitings of bilious matter came on with alarming rapidity; aqueous stools occurred incessantly; the pulse was small and concentrated; the face pale; there was great prostration of strength, and the patient complained greatly of extremely painful cramps in the legs. By the use of proper remedies, the symptoms subsided after an illness of about six hours, and debility and painful digestion alone remained.‡

A man, aged about fifty years, determined to poison himself, and for this purpose took about forty grains of tartar emetic on a Saturday morning. Vomiting, frequent stools, and convulsions soon succeeded. He was received into the Hotel Dieu on Sunday evening.

* Phil. Trans. vol. 2, p. 710. See also Note to Abridgment, vol. 1, p. 596.

† A case is quoted by Orfila, where a female swallowed six drachms. Vomitings immediately ensued, but she was soon relieved from these, and recovered without any subsequent injury. (Vol. 1, p. 169.) We can explain the *rationale* of this case, but I confess I do not understand the exemption which appears to be experienced in Italy from the ordinary effects of this powerful medicine—*miror magis*. One physician states that he has given five scruples in fourteen hours, without the patient having either *vomiting* or *diarrhœa*. Dr. Bellati also furnished a list of doses given at the hospital of Pavia, and among these is tartar emetic, *from half a drachm to three drachms daily*. Dr. Bell in Chapman's Journal, vol. 3, p. 30 and 33.

‡ Case by Dr. Barbier of Amiens, from Magendie. Orfila, vol. 1, p. 174.

On Monday morning he complained of violent pains in the epigastrium, which was distended. He could with difficulty move his tongue; he was, in fact, in such a state that he might be taken for a drunken man—he just spoke, and his pulse was imperceptible. During the day, his abdomen became inflated, the epigastrium was considerably tumefied, and became more painful; in the afternoon delirium came on. On Thursday, all the symptoms increased; in the evening there was furious delirium; convulsions supervened, and he died at night.*

The following is a remarkable case. An individual had collected about twenty-five grains of tartar emetic for the purpose of poisoning himself. He went into a coffee-house and asked for a glass of sugared water, and having dissolved the mineral in this, he drank it down. After leaving the coffee-house, which he did instantly, he had scarcely proceeded twenty steps, before he felt a burning pain in the epigastric region, accompanied by convulsive movements and a loss of his senses. He was carried in this situation to the Hotel Dieu, ten minutes after the accident. On coming a little to himself, he confessed his crime, and a decoction of bark was immediately administered in large quantities. The skin was cold and clammy, the breathing a little short, the pulse small and concentrated, and the epigastric region a little tumefied and very painful, hiccup tolerably frequent, but *no vomiting*. The symptoms gradually diminished in violence after taking the bark, and in two hours, copious stools occurred and continued for several hours. On the next day, he vomited several times, and gastritic symptoms were present for a week, but were removed by the usual remedies.†

From these and other instances, the following list of symptoms may be deduced: a rough metallic taste, nausea, copious vomitings, frequent hiccup, cardialgia, burning heat in the epigastric region, pains of the

* Case by Dr. Recamier, from Magendie. Orfila, vol. 1, p. 177.
† Case by Dr. Serres from Magendie. Orfila, vol. 1, p. 175.

stomach, abdominal colics, inflation, copious stools, syncope, small, concentrated and accelerated pulse, cold skin, but sometimes intense heat, difficult breathing, vertigo, loss of sense, convulsive motions, very painful cramps in the legs, prostration of strength, and death.* Sometimes to these symptoms is joined a great difficulty of swallowing, and deglutition may be suspended for some time.† The vomitings and alvine excretions do not always take place, and the consequence of this is an increase in the violence of the other symptoms.‡

There can be no doubt from the marked effects of the tartar emetic ointment, as stated by medical observers, and in particular by the illustrious Jenner, that its external application in large quantities would produce injurious consequences. And this indeed is amply confirmed by the results of experiments on animals, as we shall hereafter state.‖

Appearances on dissection. The mucous membrane of the stomach is usually red, inflamed and covered with mucus. The duodenum is in a similar state, and occasionally the other small intestines. The lungs are often found more or less inflamed, and in some instances, the brain is so also, and contains serous fluid. Hoffman mentions a case, where the stomach was found sphacelated, and the spleen, diaphragm, lungs, and the parts adjacent to the affected part of the stomach, were gangrenous. In a general

* Is not the case in the Edinburgh Medical Essays, vol. 1, p. 35, entitled "*The bad effects of opium given too soon to stop the operation of emetics,*" an instance of poisoning by tartar emetic ?

† Foderè quotes a case by Dr. Carron, where there was a suspension of deglutition for two days, vol. 4, p. 156.

‡ Orfila, vol. 1, p. 178. Male mentions the case of a child who had taken a large dose and in whom no vomiting occurred. He lay in a state of insensibility, the extremities were cold, the pulse languid and almost imperceptible, but by taking some strong brandy and water, these effects were removed, and violent vomiting succeeded, and the patient recovered, p. 166. See also Journal of Foreign Science, vol. 1, p. 640.

‖ Dr. Francis states that in two cases where tartar emetic was used externally in the form of ointment for a longer time than was proper, the effects upon the constitution of the patient were similar to those at times arising from arsenic employed in the same manner; a comatose state, feeble pulse, inability to muscular exertion and enlargement of the smaller joints. These consequences continued several months. Ms. communication.

way we may state, that the lungs and the mucous membrane of the digestive canal, are the organs principally affected by this poison.*

Effect on animals. Magendie and Brodie have each investigated the effects of this salt on animals.

The former ascertained that whenever the œsophagus was tied up in dogs, so as to prevent vomiting, four, six or eight grains produced death at the end of two or three hours; while those who were able to get rid of it by vomiting, often took a drachm, without experiencing any material bad effect. Large doses, (as half an ounce) however, generally caused death in a few hours, or a few days, although instances did happen, where no accident followed from their exhibition.

When a solution of tartar emetic of six or eight grains to three ounces of water, was injected into the veins of a full grown dog, vomiting and purging ensued, the breathing became difficult, the pulse frequent and intermitting, and great disquietude and tremblings of the limbs preceded death. On dissection, the lungs were observed of an orange or violet colour, and distended with blood, while the mucous membrane of the intestinal canal from the cardia to the rectum, was red and inflamed. A larger quantity injected in a similar manner, produced an earlier death, and the inflammation was confined to the lungs; but a weaker solution took a longer period to develope itself, and the lungs and intestines were equally affected.†

Externally applied, the tartar emetic produced similar vomitings and stools, and also the same lesions on dissection.

It thus appears, that as a general rule, its first effect is almost always vomiting, in those animals who are capable of this function, and the poison is thus thrown off in many cases, before it has had time to produce fatal consequences.

* Orfila, vol. 1, p. 177 to 180

† Magendie, p. 24, 36, 37.

The results obtained by Mr. Brodie were similar in many respects. When applied to a wound in animals capable of vomiting, it usually, but not constantly, operated as an emetic. Paralysis, drowsiness, and at last complete insensibility, were among the symptoms that preceded death. The stomach sometimes bore the marks of inflammation, but he never saw any appearances of it in the intestines. These experiments were performed on rabbits, and the same symptoms were present, whether the tartar emetic was injected into the stomach, or applied to a wound. The deduction drawn by Mr. Brodie from these results is, that this mineral does not produce its deleterious effects until it has passed into the circulation.*

Chemical proofs. There is considerable discrepancy among chemists as to the solubility of this salt. Dr. Duncan, jun. is said to have selected very pure specimens for this examination, and he states that one part is soluble in three times its weight of water, at 212 deg. and in fifteen at 60 deg.† Probably it would be proper, in ordinary cases, to add rather more than these proportions.

The following are among the tests of tartar emetic:

(*a*) When heated red-hot in an earthen crucible with the black flux, it blackens and decomposes, leaving for a residue, metallic antimony, and potash slightly carbonated, of a white colour.

(*b*) Sulphuretted hydrogen, sulphuretted water, and the hydro-sulphurets, when used in small quantities, throw down an orange-yellow precipitate, and a deep brown-red if employed in excess. This precipitate, after being dried and mixed with charcoal and common potash, gives, by the action of heat, a cake of metallic antimony.

(*c*) Concentrated sulphuric acid produces a white precipitate.

(*d*) Lime-water gives an abundant, thick, white precipitate, which is re-dissolved with facility by

* Lond. Med. and Phys. Jour. vol. 28, p. 126.
† Paris' Pharmacologia, p. 195.

nitric acid. Barytic water produces the same effect as lime-water.

(*e*) The infusion of nut-galls in alcohol, is the most sensible test of this substance in solution. It produces an abundant precipitate of a dirty white colour, inclining a little to yellow.

The juices of plants, the extractive decoctions of roots and barks, precipitate the solution of tartar emetic, and produce a reddish yellow deposit, consisting of oxide of antimony and a portion of vegetable matter. According to Dr. Paris, one ounce of the decoction of yellow bark is capable of decomposing one scruple of this salt, and rendering it completely inert.*

The application of tests to various mixtures, produce the following results :

Substances employed.	Red wine ten parts, and solut. tar. em. 1 part.	Red wine ten parts, sol. tar. em. 7 parts.	Infusion of tea 10 parts, sol. tar. em. 1 part.	Infus. of tea. 10 parts, sol tar. em. 6 parts.	Albumen, and sol. tar. em.	Gelatine and sol tar. em.
Effect of these mixtures on each other.	No change	No change	Very slightly disturbed.		No change	No change
Effects of tests on these mixtures.	Reddish yellow precip.	Almost black.	Deepish Red.	Reddish Orange.	Same as tar. em alone.	Same as tar. em. alone.
Hydrosulphurets						
Larger quantity of ditto.	Green p.					
Inf. nut-galls in alcohol.	Violet p.	Deeper violet.	Turbid only.	Dirty white.	Same as tar. em. alone.	Abundant precip.
Sulphuric acid.	Deep violet prec.		White pr. inclining to yellow.	White, slightly yellow.		Same as tar. em. alone.
Lime-water.					White prec.†	

Tartar emetic poured on milk, produces no coagulation, and the mixture gives a clear red precipitate

* Page 195.

† This, however, does not disappear on the addition of pure nitric acid since the albumen forms an insoluble body.

with the hydro-sulphuret of ammonia. Broth and bile diluted with water, do not alter the action of agents on the tartar emetic.*

These results prove the uncertainty of depending on the above tests solely. The precipitates should in all cases be evaporated to dryness, and the proper process for reduction with the black flux must then be employed.

Antidotes. Vomiting, if not already present, should be excited by tickling the throat and the administration of warm water in large quantities, and even if it has taken place, warm water is advisable to relieve the symptoms. If notwithstanding the employment of these means, vomiting cannot be induced, we should exhibit the decoction of bark. This was proposed by Berthollet, and its value is great, from the fact of its decomposing the salt. Strong tea, the decoction of nut-galls, or of astringent, roots and barks generally, will answer as substitutes when the bark cannot be obtained.†

Opium may be employed in excessive vomitings, and the antiphlogistic treatment is generally necessary to remove the secondary symptoms.

THE OXIDE AND GLASS OF ANTIMONY. These substances are also poisonous, even in small doses. Hoffman mentions fatal cases, produced by the latter, where the symptoms were similar to those caused by tartar emetic, and Morgagni quotes instances, where men and animals died from its exhibition. Inflammation of the stomach was observed on dissection.‡

Both the oxide and the glass being mixed with charcoal and heated in an earthen crucible, furnish metallic antimony.

THE MURIATE *(butter of antimony)* AND SUBMURIATE OF ANTIMONY. These like the former, are

* Orfila, vol. 1, p. 166–7–8.

† In his latest work, Orfila gives the preference to gall-nuts, over all the other astringents. Orfila's directions, p. 60.

‡ Morgagni, vol. 3, p. 370.

deleterious substances. Orfila quotes a case from Borrichius, where a few strong doses of the submuriate caused violent purging and vomiting, a copious salivation and extreme debility. For some time previous to death, the patient was cold as ice, his pulse was scarcely perceptible, and he breathed with difficulty. He nevertheless enjoyed all his intellectual faculties.*

These preparations may be reduced with the black flux, and the hydro-sulphurets produce a precipitate more or less red, with their solutions.

ANTIMONIAL WINE. The composition and strength of this preparation vary according to the purity of the solvent, and as this is liable to alteration, a degree of insecurity attaches to its exhibition.† And I have no doubt that children have often been injured by its administration without proper advice. I will only advert to the cases quoted by Orfila from Mangetus and Fabricius Hildanus, as proofs of the dangerous and even fatal effects of this substance. Certainly the solution of tartar emetic in water, is a far preferable prescription.

The symptoms and appearances on dissection are similar to those already mentioned. The operation of tests on wine added to tartar emetic have been already noticed, but they vary somewhat, when the glass of antimony is used. The hydro-sulphurets in small quantity give a deep red precipitate, and in large, a black one ; sulphuric acid, a deep yellow one, bordering on a grey, and the nut-galls a dirty white. In our chemical investigations, we should further evaporate the liquor to dryness, and then calcine it with charcoal. Metallic antimony will be obtained.‡

Other preparations of antimony, as the *kermes mineral*, the *golden sulphur of antimony*, the *crocus*

* Orfila, vol. 1, p. 190.

† See Paris' Pharmacologia, p. 308. *Liquor Ant. Tartarizati.* He recommends that antimonial wine be removed from the list of *officinal preparations.*

‡ Orfila, vol 1, p. 191, 192.

metallorum, &c. are also to be deemed poisonous, if given in large doses.

ANTIMONIAL VAPOURS. Fourcroy (says Orfila) relates, that he has seen fifty persons who were seized with a great difficulty of breathing, tightness of the chest, and a dry cough, gripings and purging, ten or twelve hours after having respired the vapours of sulphuret of antimony, which had been detonated with nitre. The prolonged action of these might undoubtedly lead to serious evils.*

COPPER.

The preparations of this metal are seldom used as the instruments of crime, but they are frequently poisonous through accident; and this is owing to the circumstance of copper being extensively employed for domestic utensils.

I shall notice, first, the nature of metallic copper, and then the action of its various compounds.

METALLIC COPPER. The weight of testimony is decidedly in favour of this not being poisonous, when perfectly pure. Orfila cites several cases from authors, where masses were swallowed, and after some time voided by the natural passages, without producing any injury. Dr. Paris mentions an instance where six copper penny pieces were taken, with a view of self-destruction, and no inconvenience was experienced, except the effects of mechanical obstruction. They were voided after a lapse of five years.†

* Orfila, vol. 1, p. 195.

† Paris' Pharmacologia, p. 250. The following may seem to contradict the usual results, but its peculiarities are probably to be ascribed to some previous oxidation of the metal. "A child aged three years, swallowed two copper farthings by accident, at an interval of half a year after each other. After swallowing the first, he eat nothing for ten days, complained of great pain at his stomach, and drivelled as if he had been salivated. After the second, he began by degrees to lose his flesh, and had the appearance of consumption. He was, however, perfectly cured by the Bath waters." Communication by Dr. Edward Baynard, Phil. Trans. vol. 20, p. 424. A case is also mentioned by Dr. Jackson of Boston, where the swallowing of a half cent produced nausea and vomiting, with several other symptoms characteristic of the poison. New-England Journ. vol. 3, p. 156

It is not so certain that this substance in a state of minute division, as filings for example, is equally innocuous. Portal relates a case, where they were given to an individual labouring under ascites, and while the disease seemed to yield, colic, tenesmus, and vomitings suddenly supervened.* Experiments on animals, however, with large doses of copper filings mixed with grease or oil, have produced no injury, and on dissection, their metallic brilliancy was found untarnished.

But we have always reason to dread the effects of this metal on the human system, from the facility with which it oxidates. Copper exposed to a moist atmosphere becomes tarnished, and passes into a state of oxide, which soon after unites with the carbonic acid of the atmosphere, and forms a greenish carbonate. It dissolves in the principal mineral acids, with the aid of heat. Milk however, although boiled for two hours in a clean kettle, did not contain any trace of copper, and the same result was obtained with tea, coffee, beer and rain water. But if the water contained muriate of soda, it dissolved a notable portion of copper.† Fat bodies, assisted by the oxidizing principle of the atmosphere, act with celerity on it, and Proust explains the quick corrosion and destruction of the copper sheathings of vessels, from the combined action of grease and muriate of soda. Don Raphael Clavigo, (he observes) ascertained this cause, and when he placed sheets of thick coarse paper between the plaster of fat and the copper to prevent their contact, the durability of the sheathings was secured.

We must remark, however, that the vegetable acids generally dissolve copper with difficulty, even although assisted by heat. And hence, the boiling of

* Orfila, vol. 1, p. 201.

† These experiments were made by Mr. Eller, a chemist of Berlin. He also noticed a remarkable circumstance in connection with the last phenomenon. If, instead of a simple solution of muriate of soda, it was previously mixed with beef, bacon and fish, the fluid [illegible] did not contain a trace of copper. Orfila, vol. 1, p. 202.

sugar or syrrups, in vessels of this metal, does not of itself produce any noxious compound, unless it be left to cool in them. In the latter case, the boiled substance acquires a bad taste and a green colour, and the copper forms an oxide on its surface.

These facts are sufficient to prove the necessity in all cases of tinning vessels intended for the preparation of articles of food. Numberless causes, (says Proust,) unite to accelerate the dissolution of the copper, since the juices of all viands are fat, acid, and naturally saline. It is therefore evident, that tinning is indispensable for kitchen utensils."* And this author has also shewn another advantage arising from this precaution. The usual alloy applied in tinning vessels, consists of equal parts of tin and lead, and the tin being more oxidizable than the lead, is exclusively dissolved by any vegetable acid that may be contained in the viands and thus prevents the latter from being attacked. These compounds of tin are known to be harmless.†

Copper and bell-metal mortars are evidently hazardous for similar reasons in the office of the apothecary. Not only will moisture affect them, but also many articles of the materia medica, and thus a dangerous compound may result.‡

Oxide and carbonate of copper. The carbonate (natural verdigris) forms spontaneously on the surface of copper or brass vessels, pieces of coin, &c. when treated with ammonia or water, and is of a

* Cleanliness may, however, ward off any formidable injury. "In the Orphan House at Halle, from 600 to 900 persons daily eat food dressed in large copper kettles, and yet I never heard there of any bad effects from them: here, however, I must observe, that the cleanliness was quite exemplary; that in the afternoon, we observed, with pleasure and admiration, the kitchen perfectly clean and the copper vessels bright." Michaelis' Commentaries, vol. 3, p. 338.

† Mr. Proust's papers on *Tinning*, which appeared originally in the *Annales de Chimie and Journal de Physique*, I have consulted in the Repertory of Arts, second series, volumes 6 and 9.

‡ There is a useful paper on this subject in the Medical Commentaries, vol. 7, p. 311. The author first shews that bell-metal mortars are liable to abrasion, and that thus the particles may be united with medicines, and next that some substances will act chemically on them.

green colour. The oxide is of a blackish brown colour. Both of them are highly poisonous, and colic and vomiting are their usual symptoms.

From the remarks made in the previous section, it will be readily understood, why copper utensils when not properly cleaned, contaminate acid substances boiled in them. Vinegar dissolves the oxide with ease, as does also ammonia. Eller has proved that wine dissolves copper, doubtless in consequence of the acetic acid contained in it and the oxidation of the metal by the air.* And we can explain in the same way, the production of the acetate in the cocks of vessels from which wine, beer or cider is drawn. "Drouard was affected for three days with colic and diarrhœa, in consequence of eating a ragout which had been seasoned with wine drawn out of a cask, the cock of which contained acetate of copper, which this liquor had in part dissolved." Fat bodies, such as fixed and essential oils, &c. dissolve the oxide and carbonate of copper with readiness, and hence Proust very justly condemns the use of copper measures for oil.†

The tests of these compounds are similar to those of verdigris, which we shall now notice.

Verdigris. The compound substance known under this name, is the preparation of copper which most frequently produces deleterious effects. Orfila has collected numerous cases, illustrating its action, and I conceive it will be useful to state the mode in which the respective individuals were poisoned. In one instance, a family consisting of nine persons were affected; the first of these by a cake made with melted butter, and skimmed with an instrument of copper, upon which the fat body had been allowed to cool; five from

* Moseley relates that in 1592, at a meeting of the great senate of Bern, the wine was put into copper vessels, and suspended in a well in order to cool it. In a few days, the legates and others who had drank, were seized with violent pain in the abdomen, fever and dysentery, and many died. Moseley on Tropical Diseases, p. 331.

† Orfila, vol. 1, p. 203 to 206. In several cities in Europe, distillers, apothecaries, and others, are forbidden to use copper vessels unless they are tinned. Ehrmann in Schlegel, vol. 3, p. 230.

some broth and meat coming out of a saucepan, skimmed by the same skimmer, and the remainder by a fricasee of pigeons, prepared in the same pan. The Jacobin Friars in Paris, to the number of twenty-one, were poisoned in 1781, by eating some ray, which had been cooked in a copper vessel. The cook, after taking out a part of the water, had poured vinegar on the fish to render them more firm, and in this state they had stood for some time away from the fire. Some veal placed in an earthen pot, to which there was a copper lid, and which lid laid directly on the meat, affected two individuals. So also eggs, prepared with sorrel and butter in a copper vessel, which was covered with verdigris. Dupuytren mentions a case where a whole family was poisoned from eating lobsters, which had been cooked, and afterwards placed in a copper kettle, with vinegar poured over them. Even pease, which remained for a day, in the copper vessel, have produced all the characteristic effects of poisoning from copper.*

Verdigris itself is also sometimes used as the instrument of suicide.†

It is not necessary to copy the detail of any particular case, since the leading symptoms in all, are generally very similar. They are thus stated by Orfila: "An acrid, styptic, coppery taste in the mouth, parched and dry tongue; a sense of strangulation in the throat, coppery eructations, continual spitting, nausea, copious vomitings, or vain efforts to vomit, shooting pains in the stomach, which are often very severe; horrible gripes, very frequent alvine evacuations, sometimes bloody and blackish, with tenesmus and debility; the abdomen inflated and painful; the pulse small, irregular, tight, and frequent; syncope, heat of skin, ardent thirst, difficulty of breathing, anxiety about the præcordia, cold sweats, scanty urine,

* Medico-Chirurg. Review, vol. 1, p. 158, quoted from a French Med. Journal.

† See Metzger, p. 396, who quotes a case from Pyl. The verdigris was found in the pylorus, and it had tinged the fæcal matter.

violent headach, vertigo, faintness, weakness in the limbs, cramps of the legs, and convulsions." All these, however, do not generally occur in the same individual, but vomiting and colic are very constant.*

Gangrene sometimes takes place in the intestines, and this disease is then accompanied with its usual premonitory appearances.

Appearances on dissection. The alimentary canal is the organ principally diseased. When death ensues within a few hours after taking the poison, the mucous lining of the stomach and intestines is found to be inflamed and gangrenous, and this extends even to the rectum. In one instance, that intestine was found pierced at two points. Sometimes the inflammation extends to all the coats, and sloughs are formed, which leave openings, through which their contents pass out, and are effused into the cavity of the abdomen.† Metzger remarks, that the green colour of the salt tinges all the fluids contained in the primæ viæ.‡ Inflammation of the brain has occasionally been noticed.‖

Effect on animals The experiments of Drouard on dogs, led him to the conclusion, that verdigris acts immediately on the alimentary canal, in which it excites inflammation, without being taken up into the circulation by the lymphatic vessels. To a young dog, twelve grains were given, which produced death in twenty-two hours. The stomach was found inflamed, and exhibited a black spot, which might have been taken for an erosion. The small intestines showed no marks of inflammation, but the rectum contained small ecchymoses, similar to those in the stomach. In another instance, the stomach and duodenum were inflamed, and the rectum natural.

When a small quantity in solution was injected into the jugular vein, death ensued in half an hour.

* Hiccup was a constant symptom in a fatal case witnessed by Dr. Percival. Trans. College Phys. London, vol 3, p. 80. The cause was an immoderate use of pickled samphire, impregnated with copper. A rash on the surface of the body, has also been observed in some cases.

† Orfila, vol. 1, p. 224. ‡ Metzger, p. 131. ‖ Male, p. 147.

The trachea and bronchiæ were filled with frothy mucosities, and the great vessels were distended with black and fluid blood. But in a dog who survived to the fourth day after this operation, nothing peculiar was observed either in the digestive organs or the vessels. Large doses indeed seem to produce sudden death, preceded by vomiting, convulsive motions, great insensibility and paralysis, and present at the same time but slight alterations on dissection. Orfila considers these facts as invalidating the doctrine of Drouard, and conclusive in favour of the absorption of the poison, and its action on the nervous system.*

Chemical proofs. *(a)* Sulphuric acid poured on the verdigris in powder, decomposes it with effervescence, and vapours of acetic acid are disengaged. But it must be recollected, that no such effect is produced with natural verdigris, (carbonate.) Here acetic acid should be poured on it, and the subsequent tests applied.

(b) Sulphuretted hydrogen decomposes it, and precipitates a black sulphuret of copper. This is said by Sylvester to be a very delicate test.

(c) A clean plate of iron immersed in the solution, becomes covered in a few hours with a portion of the copper, and the blue colour of the solution grows first green, and then turns to red.

(d) Caustic potash precipitates it of a sky-blue colour, and in larger quantities, of a deep blue. The sub-carbonate of potash likewise gives a sky-blue precipitate.

(e) Ammonia gives a blue precipitate, but if added in excess, the precipitate re-dissolves, and the liquor is of a beautiful blue colour.

(f) Arsenious acid in solution gives an abundant green precipitate.

(g) Chromate of potash, a yellow precipitate.

(h) The triple prussiate of potash and iron in solution, gives a brown precipitate. When very dilu-

* Vol. 1, p. 212 to 216.

ted, it will only produce a red colour in the mixture, without any turbidness, but at the end of about twenty minutes, the brown precipitate will fall. This is one of the most minute tests of copper.

(i) If the suspected substance be in powder, it should be mixed with charcoal and heated to redness in an earthen crucible. Metallic copper will be formed. The same process is proper, when the fluid is combined with substances which prevent the action of tests. Evaporate it to dryness, and then calcine with charcoal.

The following are mentioned as the effect of animal and vegetable substances on it. The infusion of tea decomposes the solution of the acetate of copper, and a flaky precipitate of a reddish yellow colour is produced. If one part of a concentrated solution of verdigris be added to ten parts of red wine, the liquor preserves its tranparency and the hydro-sulphurets give a black precipitate; the prussiate of potash, a brown, and ammonia a very dark brown. Seven parts of the solution of verdigris and ten of wine furnish a fluid, with which the above agents produce similar results, except that the precipitate from the ammonia is of a black colour. It readily follows from these, that this alkali is of no use in detecting verdigris if it has been mixed with wine.

If albumen be poured upon the acetate of copper, a bluish coloured precipitate will be obtained. Gelatine produces no effect, whatever may be the temperature of the mixture, and the tests act exactly as if the acetate of copper were alone. Broth furnishes no precipitate, but milk is coagulated by a large quantity of the solution of verdigris, and the coagulum, when properly washed, is of a deep green colour. Sugar by trituration with verdigris renders it nearly insoluble in cold water.*

In certain cases however, no vestige of the poison can be detected, from its having been vomited up during life. Orfila recommends that we should then

* Orfila, vol. 1, p. 206 to 211

scrape off the mucous membrane of the stomach and intestines, dry it and submit it to the action of strong heat in a crucible. He has twice, he observes, obtained metallic copper, by calcining in this manner a portion of the membranes of two dogs, poisoned by verdigris, and this effect particularly takes place when the mucous membrane is of a bluish colour, hard and strongly adhering to the substance of the stomach.*

Antidotes. The investigation of M. Marcelin Duval, and the earlier experiments of Orfila, seemed to prove that *sugar* was the antidote for verdigris. It allayed the pain and other alarming symptoms, and produced a great number of liquid stools.† Subsequent researches have however diminished the value of this substance. It is useful in calming the irritation, when the poison has been expelled by vomiting, but it exerts no chemical action on it, and animals on whom the œsophagus was tied, died notwithstanding large doses of syrup were administered. When *albumen* was given under similar circumstances, the animal survived several days, experienced no remarkable change, and after death, no lesion was found.‡ It is hence the proper antidote, while sugar and its preparations may be used to aid its operation.

Should any inflammatory symptoms remain after the presumed evacuation of the poison, they should be treated like gastritis, and opium and antispasmodics may be indicated for the spasmodic affections that are apt to remain.

The *acetate, sulphate, muriate, nitrate and ammoniaret of copper,* are all poisonous to the human system, and they are to be detected by most of the tests already enumerated, but most decisively by the reduction of the metal. So also with coppery wine or

* Orfila, vol. 1, p. 231

† A late case is recorded in the Medico-Chirurg. Review, vol. 1, p. 158, Amer. Edit. where sugar apparently saved the life of the patient. After the second draught of sugar and water and whites of eggs, the vomitings and epigastric pains ceased : he fell asleep and awoke quite well.

‡ Orfila, vol. 2, p. 466.

vinegar. The tests here are uncertain, and the only mode left, is to evaporate to dryness, and calcine the residue with charcoal, in order to obtain metallic copper.

ZINC.

The SULPHATE OF ZINC, from its frequent use in medicine, may, by accident, be taken in improper doses. Its property, however, of readily exciting vomiting, will prevent, in most cases, any very serious consequences. In the experiments of Orfila, he found that when given to dogs in large doses, it caused frequent vomitings, but they recovered in a short time. When, however, a solution of it was injected into the jugular vein, violent and often ineffectual attempts were made to vomit, and death followed in a few minutes. So also when the œsophagus was tied. The animal died on the third day, and on dissection the mucous membrane of the stomach was found of a deep red colour throughout its whole extent, and black spots were occasionally seen upon the muscular coat from extravasated blood. The lungs were less crepitating than usual, and their colour was rather dark.

Cases are also recorded of its effects on the human system. In a female who by accident drank down a solution of two ounces, it produced an excessively astringent taste, a contraction about the throat, burning heat at the stomach, cold extremities, pale countenance and convulsive pulse. Vomiting, however, soon intervened, and by the aid of proper remedies, the consequent irritation of the nervous system was subdued. In another case, violent pain in the epigastric region came on and was succeeded by vomitings and continual stools. These gradually diminished and he recovered.*

From these cases we may consider the following as

* Orfila, vol. 1, p. 570. "A female partook accidentally and very moderately of a cake impregnated with white vitriol, which had been prepared for the destruction of an old man. He was seized with violent vomiting, but the woman died." Ballard, p. 396.

the chain of symptoms which will result from taking this salt in large doses : " an astringent taste, sense of strangulation, nausea, copious vomitings, frequent stools, pains in the epigastric region, extending afterwards over the whole of the abdomen, difficulty of breathing, frequency of pulse, paleness of the countenance and coldness of the extremities."

Appearances on dissection. I cannot find any examination made after death on the human subject ; but it is probable from the dissection of animals, that there would hardly be any thing observed, except an inflammation of the membrane with which the salt had come in immediate contact.

Chemical proofs. Sulphate of zinc is very readily soluble.

(*a*) Potash and ammonia precipitate from it a greenish-white oxide, easily soluble in an excess of the latter alkali.

(*b*) Prussiate of potash causes a deep blue precipitate.

(*c*) The hydro-sulphurets, a blackish one.

(*d*) Chromate of potash, an orange yellow.

(*e*) The precipitates should be evaporated to dryness, and they or the solid substance found, may be mixed with caustic potash and charcoal, and then reduced by a high heat. Metallic zinc is obtained, after a considerable interval.

Gall nuts and an infusion of tea produce a deep violet blue precipitate ; Burgundy wine, and water saturated with sugar, occasion no change, but albumen and gelatine give a white precipitate, and bile, a yellow one. Milk is curdled by a tolerably large quantity of this solution.*

Treatment. We should endeavour to promote vomiting by administering warm water and emollient drinks. Milk is particularly proper, from its power of decomposing the sulphate. We must guard against

* Orfila, vol. 1, p. 265, 266.

the approach of inflammation, and allay irritation by anodynes.

Oxide of zinc. This can hardly be considered a very deleterious substance. In large doses, it produced vomiting in animals, and probably would have the same effect on the human system.

It is a problem of considerable interest, whether metallic zinc is a safe substance for domestic utensils. It has been repeatedly recommended for this purpose, by individuals on the continent of Europe, but the examinations made by chemists are decidedly unfavourable to it. Proust suggests several objections with reference to its manufacture, such as the effect of heat on it, and the difficulty of soldering; but the most important is its facility of oxidation. The atmosphere alone produces this effect, while vinegar dissolves it and forms an acetate.* Several commissions have been appointed in France to examine into the propriety of employing this metal. Vauquelin and Deyeux, reported to the medical faculty of Paris, that water when suffered to remain in vessels of zinc, decomposed it, and produced a white oxide. Vinegar caused an acetate, which was ascertained by re-agents. Citron juice and sorrel, each produced on boiling, their respective compounds with the metal. Muriate of soda in solution furnished a liquor which gave a precipitate of oxide of zinc. Lastly, butter heated in a sauce-pan of zinc, destroyed the polish of the vessel, and there was even formed by the heat a small hole in the bottom of it. It is therefore impossible, (they remark) to employ it for kitchen utensils, without incurring the hazard of its being united, either in the state of oxide or salt, with domestic viands.†

The French Institute also appointed a committee, at the request of the ministers of the interior and of war, to enquire into the propriety of its use for the

* See Proust's paper, already quoted.

† Repertory of Arts, second series, vol. 23, p. 178.

fabrication of measures for liquids, and for vessels and utensils for the use of military hospitals. It consisted of Portal, Berthollet, Deyeux, Vauquelin, and Guyton Morveau. They repeated several of the previous experiments with similar results. Even distilled water, heated in a sand bath, dissolved part of the zinc, and formed a hydrate, which possessed a distinct metallic taste.

The commission remark, that although the oxide itself may not be dangerous, yet if zinc vessels be used for domestic purposes, we shall have a variety of salts produced from the numerous ingredients that are employed for food. And it is impossible that these can be healthy; nor indeed can it be otherwise but that some will prove noxious. They therefore advise against the adoption of this metal.*

TIN.

In its metallic state, this substance is not poisonous; but a preparation much used in the arts, is highly deleterious, viz.

The muriate of tin. Three quarters of a grain dissolved in two drachms of water, and injected into the jugular vein of a small dog, produced a species of catalepsy, which gradually passed into complete paralysis and insensibility, and death followed in twelve hours after the application. Two grains injected in a similar way, destroyed the animal in fifteen minutes—tetanic convulsions preceded the termination. Lastly, six grains caused vertigo and death in one min-

* Repertory of Arts, second series, vol. 25, p. 247, 313. A third report was made some time previous by Chaussier, Gay Lussac and Thenard, on the question whether *canteens of plated zinc* were advisable for the French armies. They state among other results, that common wine, vinegar, and even mixtures of vinegar and water, dissolve the metal, and give out hydrogen. The plating of zinc vessels internally with tin has been attempted, but it was abandoned, from the acrid and disagreeable flavour given to the meat, and they add, that tin does not appear capable of coating zinc in such a manner as to guard it against the action of acids. Lastly, plates of zinc, when soldered together, have too little solidity, and are apt to give way. They therefore gave a decided opinion against the introduction of either plated zinc or tinned zinc, for the above purposes. New-York Med. Repository, vol. 17, p. 88.

ute after the injection. On dissection, the lungs were found more or less shrivelled, and partially gorged with blood; the blood itself was dark-coloured, and there was a slight redness of the mucous membrane of the stomach and duodenum. When muriate of tin was introduced into the stomach, it excited violent vomiting and death, without convulsions or paralysis. The mucous membrane of the stomach, on examination, appeared of a dark-red colour, was hardened, horny, and as it were, tanned. It was also ulcerated in various parts, and the intestinal canal contained much black, thick, ropy bile. The lungs were sound.

There are no cases on record, I believe, of death being produced on the human subject by the use of this substance, but from a narrative given by Orfila, as to the effect of a small quantity taken by accident in food, it is evident that it may prove highly deleterious. Colic was produced in all the individuals, and diarrhœa accompanied this in two of them.

Among its *tests* are the following:

(*a*) The addition of corrosive sublimate in solution, produces a white precipitate.

(*b*) The muriate of gold, a purple precipitate.

(*c*) The hydro-sulphurets render it turbid, and separate from it a blackish powder.

(*d*) The prussiate of potash causes a white precipitate, which soon becomes blue on exposure to the air.

The action of the muriate of tin on animal and vegetable fluids, is very distinct and powerful.

A strong infusion of tea, and the infusion of gall-nuts in alcohol, give an abundant precipitate of a clear yellow colour. A small quantity of the muriate dropped into Burgundy wine, produces a violet coloured sediment. Albumen precipitates it of a white colour. Gelatine decomposes it, and produces a white, flaky precipitate. Milk is converted by a few drops into thick curds, which, on being dried, are of a yellow colour, and friable. Human bile added to it, produces flaky curds.

Simple syrup (water saturated with sugar) seems to be the only substance that does not occasion any change in the solution.

These results invalidate the importance of tests, and it is therefore proper in all cases, according to Orfila, to dry the precipitates, and calcine them in a crucible with caustic potash. Metallic tin will be produced.

Antidote. It is evident from the experiments of Orfila, that *milk* acts as an antidote to this poison. It is completely coagulated, and the coagulum contains muriatic acid and oxide of tin, and is not deleterious. The antiphlogistic treatment may be subsequently necessary, if symptoms of inflammation supervene.*

The *oxide of tin* has also proved destructive to animals who have been made to swallow it.

SILVER.

Nitrate of silver. (*Lunar caustic.*) A small quantity of this salt in solution, injected into the jugular, produced difficult respiration, the appearance of suffocation, efforts to vomit, pain, convulsions and death. On dissection, the lungs were seen of a rose colour, the heart was distended with blood, and in one instance, the mucous membrane of the duodenum was of a bright cherry red. When the œsophagus was tied to prevent vomiting, and twelve grains in the solid form were introduced into the stomach, death followed in six days, without any previous symptoms, except debility, intense thirst, and frequency of pulse. The mucous membrane was perforated in a number of places, with small scars, of the size of a pin's head. The lungs were however sound. Again, twenty grains in solution were administered to a dog, and produced only uneasiness and dejection. On the third day thereafter, thirty-two grains more were given, which caused vomiting of a pulpy matter. Of this he again recovered. On the fifth day, the œsophagus was tied

* Orfila, vol. 1, p. 247 to 261.

and thirty-six grains introduced. It was followed by excruciating pain, and he died on the night of the succeeding day. The examination after death presented the mucous membrane of the stomach dissolved into a pulp, and eschars of a greyish white colour were seen near the pylorus. The muscular coat was inflamed, but the lungs were healthy.

There are but few instances on record of injury done by the nitrate of silver to the human subject. Orfila relates from Boerhaave, that a student of pharmacy swallowed some lunar caustic, and excruciating pains, gangrene and sphacelus were the consequences; and Metzger alludes to a case, where the most imminent danger followed, from a surgeon letting a piece drop into the throat of a patient, whose ulcers he was touching with it.* Its effects on the skin, are an illustration of its probable operation on the throat, stomach, &c.

Tests. (*a*) When thrown on burning charcoal, it is decomposed. Vapours of nitrous gas are given out, and the metallic silver remains upon the charcoal.

(*b*) The solution stains the skin black.

(*c*) Muriatic acid and the soluble muriates precipitate the corneous muriate of silver, which is white and curdled.

(*d*) Potash, soda and lime-water produce a deep brown precipitate. Ammonia produces no turbidness.

(*e*) The hydro-sulphurets give a black sediment.

(*f*) Arsenious acid causes a yellow precipitate, which on exposure to the air, becomes black.

(*g*) Phosphate of soda, produces a yellow precipitate.

(*h*) Prussiate of potash, a white precipitate.

As to the effects of nitrate of silver on animal or vegetable substances, the following may be noticed:

The alcoholic solution of gall nuts produces no change.

* Metzger, p. 397

If ten parts of Burgundy wine be added to one of a solution of nitrate of silver, the fluids become slightly turbid and acquire a violet colour. The muriatic acid produces a white precipitate of this mixture, the hydro-sulphurets a greenish brown, and the phosphate of soda a violet blue.*

When fifteen parts of an infusion of tea are added to two parts of a solution of nitrate of silver, a flaky precipitate occurs of a deep purple-red, bordering a little on black. If one part of nitrate of silver was employed, the mixture was of a yellow colour, but passed first to a red and then to a black colour, without affecting its transparency. In this state, muriatic acid gave a yellow sediment.

Albumen gives a copious white precipitate, broth a yellowish-white one, and bile an orange-yellow one. Gelatine causes no change. Milk is coagulated; a formation takes place of small white curds, and the fluid becomes transparent.

Antidote. Muriate of soda appears from the experiments of Orfila to counteract the effects of nitrate of silver. It produces an insoluble muriate, which has no power on the system. Hence salt water, aided by emollient and mucilaginous drinks, is advisable.†

Fulminating silver, according to the experiments of M. Pagot Laforet, also acts as a violent poison on animals in small doses. But if charcoal, mixed with water, was administered in quantity immediately after the exhibition of the poison, the symptoms ceased, and no further injury was sustained.‡

GOLD.

Nitro muriate of gold, injected into the jugular of animals, produced death apparently by causing

* Chlorine will not answer as a decolorizing application in this case, as it decomposes the nitrate. Orfila, London Med. Rep. vol. 14, p. 509.

† Orfila, vol. I, p. 274 to 287.

‡ London Med. and Phys. Journ. vol. 25, p. 457, quoted from the *Journal General de Medicine.*

suffocation. The succession of symptoms were vertigo, deep respiration, plaintive cries, and occasionally vomiting. They expired in a few minutes after the operation. On dissection, the lungs were seen gorged with blood, the heart was full of black blood, but the mucous membrane of the stomach and intestines was sound.

Death also followed from taking this substance into the stomach, and the mucous membrane was, on dissection, found abraded in several places.

We have no cases on record of poisoning by this salt, but it is evident from the preceding observations, and also from its effects as an article of the materia medica, that it exercises a powerful action on the human system. It has come within my observation, to have seen a case of dropsy removed by its use in a very short time.

Tests. (*a*) When thrown on burning charcoal, it is decomposed, and converted into metallic gold, and the chlorine is given off.

(*b*) It stains the skin of a purple colour.

(*c*) Sulphate of iron produces a brown precipitate, and pellicles of gold are seen floating on the surface of the fluid.

(*d*) Muriate of tin produces a purple precipitate.

(*e*) The hydro-sulphurets cause a deep chocolate-coloured precipitate.

(*f*) *The prussiate of potash produces no effect.*

Effects of animal and vegetable fluids. Muriate of gold is not affected by syrup; is precipitated reddish-yellow by tea; red, chocolate-coloured, and afterwards metallic, by tincture of galls; deep-purple and metallic by Burgundy wine; yellow by albumen and gelatine; and green, passing into purple and violet, by bile. It also instantly curdles milk.* Chlorine decolorizes the mixture with wine, and leaves the tests to operate in their usual manner.

Antidotes. Dr. Thomson recommends the sulphate

* Orfila, vol. 1, p. 288 to 296.

of iron for this purpose, from its property of decomposing the salt, and throwing down the gold in its metallic state.* Orfila recommends the antiphlogistic treatment generally, and in particular the use of emollient and mucilaginous drinks.

Fulminating gold appears to have proved highly deleterious in several cases quoted by Orfila from Plenck and Hoffman. Vomiting, spasm, diarrhœa, faintings and death, were the consequences of the administration of a few grains, (three to six.) Rivinus mentions having found holes in the intestines of a child poisoned with it.†

PLATINA.

I conceive there can be but little doubt that the *nitro-muriate of platina*, if taken internally, would prove a violent poison. Being, however, a rare article, and confined to the laboratory, it does not require a minute notice; but the following fact is curious, and deserving of attention. "A person has been uniformly affected with erythema of the face, during the last six or seven years, every time he opens a bottle containing the liquid nitro-muriate of platina, within two or three feet distance, and without touching the face. The same effect is produced by opening a bottle containing dry ammonia, or oxide of platina. If the smallest particle of these substances be brought into contact with the face, even the fingers, though they be carefully wiped after touching these preparations, if they come in contact with the face, the erythema is excited. It spreads rapidly over the skin of the face, feeling very hot, itching extremely, and causing a pale rose-red colour. In two, three, or at most four hours, this slight disease disappears."‡

BISMUTH.

Nitrate of bismuth, in its crystallized state, was

* Annals, vol. 5, p. 385. † Orfila, vol. 1, p. 297.
‡ Edinburgh Med. and Surg. Journal, vol. 8, p. 524.

boiled in distilled water, and the fluid afterwards filtered. When this was injected into the jugular vein, it produced retching, plantive cries, convulsions of the limbs, palpitation, difficulty of breathing, and general depression and death. The lungs were dark coloured, but tinged only in particular parts, or wrinkled. The left ventricle and arteries contained only a little black blood. The *subnitrate of bismuth*, on being introduced into the stomach, produced a vomiting of white ropy matter, deep and difficult respiration, trembling of the limbs and death. The mucous membrane of the stomach was either highly inflamed or extensively ulcerated, so that the slightest friction separated it in the form of pultaceous scraps. Portions of the lungs were gorged with blood.

When the white oxide of bismuth has not been prepared with sufficient care, it often happens, that violent vomiting, diarrhœa, and other unpleasant symptoms will ensue from its administration. And I venture to suggest, that the instances mentioned by practical writers, have arisen from this cause. In one case where the precipitate produced by adding water to the nitrate, did not undergo the repeated washings which are necessary, I have known it to cause the most alarming vomiting. It is certainly not yet established, that the white oxide, when pure, will cause any injurious effects.

Tests (a) Sulphuretted hydrogen causes a black precipitate.

(b) The prussiate of potash, a pale yellow.

(c) Ammonia causes a white precipitate.

(d) The chromate of potash, a beautiful orange-yellow.*

(e) The tincture of galls, a flaky pale yellow.

(f) On the addition of water, the fluid becomes milky, and a white precipitate gradually subsides.

(g) The precipitates, on being calcined with charcoal in a crucible, give out the metal.

* So also, says Dr. Cooper, does corrosive sublimate with Chromate of potash.

Nitrate of bismuth is precipitated pale yellow by tea, yellow by bile, and white by albumen and milk. The last is curdled by it. Gelatine is not affected. Burgundy wine gives a rose coloured precipitate, inclining to violet. The supernatant fluid preserves the red colour of the wine, but the hydro-sulphurets on being poured into it, produce a black precipitate.* Ammonia deprives it of its colour, without occasioning any sensible white precipitate.

Antidotes. Milk, and mucilaginous drinks; and if symptoms of inflammation supervene, the antiphlogistic regimen.‡

IRON.

Sulphate of iron. This salt has proved an active poison to animals in the hands of Dr. Smith. When applied in the dose of two drachms, to the cellular texture of the inside of the thigh of two dogs, it killed them in the course of twelve or fifteen hours. On dissection, the internal surface of the stomach of one of them, was found covered with a multiplicity of petechial spots. The wrinkles of the rectum were numerous and black; the liver whitish, with livid spots on its convex surface; while the heart contained black grumous blood, and its ventricles had some slight livid blotches.

When introduced into the stomach in the dose of two drachms, it did not destroy life in less than twenty-six hours, and without any other apparent symptom than a general insensibility; the interior of the stomach exhibited red spots; the small intestines presented blackish puffy swellings, and the upper part of the rectum shewed red folds.‡

* On the addition of chlorine, the mixture is rendered colourless, and the tests produce their ordinary effects. *Orfila.* Lond. Med. Repos. vol. 14, p. 409.

† Orfila, vol. 1, p. 298 to 307.

‡ Orfila, vol. 2, p. 468.

LEAD.

This metal differs materially from those we have already noticed, in its effects on the system. It frequently produces a constriction of the intestines, and hence has been styled, an *astringent* poison, whilst the others have been characterised as *corrosive* or *acrid* ones. We shall, however, find that inflammation is not an uncommon consequence from its exhibition, and in his last work, Orfila arranges it among the corrosive or irritating poisons.

I shall notice some of the compounds.

Acetate of lead. There are but few cases recorded of poisoning by this substance. The following, however, is related in a late publication. It occurred in the person of a soldier, who drank a considerable quantity of the solution. He was soon seized with the most violent symptoms, indicative of gastric inflammation. A sense of suffocation, drawing in of the belly, costiveness, cold and clammy sweats, and trismus, were present. He died in great agony at the end of three days. On dissection, the lead was discovered by proper tests in the fluids of the stomach. The mucous membrane of that organ was abraded in several places, particularly near the pylorus; and the œsophagus, stomach, duodenum, mesentery, liver and spleen, were in a state of high inflammation.*

Dr. Shearman has also observed fatal effects to follow from an adulteration of gin with sugar of lead. The symptoms were, occasional violent colic pains, chiefly occurring after meals, attended with an obstinate costiveness, and although these were for a time relieved by purgatives and other means, they almost universally recurred. The progress of the disease, he observes, even in those cases where it attained its

* Transactions Coll. Phys. London, vol. 6, p. 39. Case by Dr. Kerchkoffs. The editors of the London Med. Intell. in remarking on this case, observe, that they once saw a gentleman die with similar symptoms, after swallowing about three ounces of solution given to him by a quack for an injection. New-England Journal, vol. 10, p. 86.

utmost violence, was in almost every instance so insidious and slow, as to leave the observer unapprehensive of its true character, which, however, was at last brought to light.*

Instances are, however, stated, where this salt in quantity has not produced any injurious effects. An apprentice of a cooper, near Glasgow, had an ulcer on the tibia, accompanied with considerable inflammation, for which he was ordered a poultice with acetate of lead. As this article is much used by linen printers, he procured in an adjoining print-field, a lump, which could not have weighed less than a pound, being, as he said, of the size of his fist. On coming down, he laid it on the kitchen-table, and shortly after went away. His mistress, an old, short-sighted woman, soon came in with cabbage for the family dinner—laid it on the table upon the lead, without perceiving it, and cut them down with a knife. By this operation, both were incorporated into one mass, and the whole was put into a pot, boiled with potatoes, and afterwards chopped together for dinner. This dish was eaten by the master and mistress, their daughter and her husband, and two apprentices. Soon after, the lad wished to prepare his poultice, but the materials could not be found. As a curious taste had been observed by all of them in their food, they became alarmed, and on examining the table, it was evident that the sugar of lead and the cabbage had been bruised together, as some of the former in a powdered state still adhered to it. Mr. Hunter of Dumbarton was immediately sent for. He gave to five of them an emetic, which operated well, and they experienced no disagreeable symptoms afterwards. The sixth person, an apprentice, refused to take any thing, as he felt no uneasiness, nor did he subsequently experience any disorder in his bowels.†

* Edinburgh Med. and Surg. Journal, vol. 8, p. 213, from Trans. Med Soc. London.

† London Med. and Phys. Journal, vol. 9, p. 173. Case by Mr. Hunter of Dumbarton.

I may add to the above, that I have known a drachm taken by mistake, without producing any ill effects. And I was at one period disposed to attribute the exemption in these instances, to the absence of sulphate of lead, with which, it is well known, the acetate of lead of commerce is often adulterated. The experiments of Orfila on animals, (which I shall presently state,) however, sufficiently establish the poisonous nature of the acetate, even if we had not instances of it on the human subject, and we must therefore ascribe the escape in these cases, to accident, constitutional strength, or some fortunate state of the stomach and bowels.*

I have too often witnessed the value and efficacy of acetate of lead in pulmonary and uterine hæmorrhages, not to feel a great partiality for it as an astringent medicine. I know of nothing that can be substituted, in extreme cases. But I must stop here, and unequivocally condemn the practice which has occasionally obtained of late years, of administering this salt in diarrhœa. It is not necessary at this time, to point out the reasons why it must prove injurious—it is sufficient to say, that death, preceded by all the symptoms of acute poisoning, has been the consequence of its exhibition. We have the authority of my friend Dr. Mann, late hospital surgeon in the United States army, in asserting, that during the war of 1812, several officers of rank fell victims to its use.†

Effects on animals. When a solution of the acetate of lead, containing from one to three grains, was injected into the jugular of dogs, it did not appear to incommode them. Once or twice only, the animals made some slight efforts to vomit, and threw up a small quantity of whitish stringy matter. Five grains did not at first appear to produce any effect; but on the third day, the animal became dejected and refus-

* He seems also to have shewn, that sulphate of lead is innoxious. See vol. 1, p. 485.

† New England Journal, vol. 11, p. 19

ed to take food. On the fourth his gait was unsteady and difficult, his posterior extremities occasionally exhibited some convulsive movements, and he was extremely weak. He died on the fifth day, and the lungs and stomach were found healthy. Thirteen grains injected in this way, produced instant death without any signs of pain or convulsions. The blood in the left ventricle was fluid, and of a vermilion red colour.

When the acetate was taken into the stomach in a solid form, and in doses of from three drachms to an ounce or more, it excited vomiting, dejection, and death. The mucous membrane of the stomach was inflamed, and spots of a dark colour were observed on it; the intestinal canal and lungs were healthy. Its effects when given in solution, were a loss of muscular power, trembling of the limbs, and vertigo. The mucous membrane was of a grey ash colour.*

As the chemical proofs of all the preparations of lead are in many respects similar, we shall notice them at the conclusion of this article.

Carbonate of lead, (*cerusse or white lead*) We have a remarkable case on record, of the noxious effects of this substance on the human system.

Mr. Deering, a surgeon in London, was requested on the 21st of October, 1803, to visit Mrs. R. the wife of a respectable tradesman in Aldersgate-street, who complained of violent pain in the scrobiculus cordis, with great soreness of the epigastric region when pressed upon. She had vomited a considerable quantity of bilious matter, and at the same time her bowels were constipated; the pulse was calm and regular, the tongue clean and moist, and there was no symptom of fever present. A cathartic was administered, which operated, and an opiate given in the evening. The following morning she appeared relieved; but in the evening, the pain and vomiting recurred, and these symptoms continued for some suc-

* Orfila, vol. 1, p. 457 to 461

cessive days, in so distressing a degree, that it was deemed advisable to consult the family physician, which was done on November 4, 1808. At this time these symptoms continued as already intimated, without any appearance of fever, and hence the physician was induced to consider the affection as of a rheumatic and spasmodic nature.

In a few days, in consequence of the amendment of the patient, he discontinued his visits. In about a week after this period, a boy in the same family, nearly sixteen years of age, was seized with symptoms exactly similar to those of the preceding case, and similar remedies afforded only partial relief, till at length he was removed into the country, and thereby recovered his health.

A week after the attack of this youth, the eldest child, a boy six years old, was also seized with analogous symptoms, and the mother having relapsed into her former state, the physician was again consulted on the 19th of November. At this time, three other persons in the family laboured under similar affections, and suspicions were now entertained that some poisonous substance might have caused this general indisposition of the family; but after minute investigation, no one circumstance was discovered to confirm this suspicion, or to elucidate the source of so extensive a calamity.

The sickness and pain continued unabated in Mrs. R. but the son, after the period of a fortnight, was deemed in a state of convalescence by his physician, who discontinued his attendance; he was, however, soon after seized with convulsions, and expired within a few hours. Unexpected and severe as this shock was, Mrs. R. afterwards gradually grew a little better. She had hitherto continued to suckle her child, which, it being fifteen months old, she was advised to wean: to this she reluctantly consented. In about ten days afterwards the child became somewhat costive, without any other apparent indisposition; but at this period it was seized with vomiting and con-

vulsions, and suddenly expired. The unhappy parent now experienced a return of her complaints, and, under a persuasion of the inefficacy of professional aid, she was prevailed upon to consult an empiric, whose attendance, though continued to the end of the year, proved unavailing; and on the 3d of January, 1809, she had the advice of Mr. Chevalier, an experienced surgeon, who considered the patient's complaint to be chronic rheumatism; and by the use of clysters of warm water, oily mucilaginous medicines, fomentations, and vesicatories, she appeared to experience more relief than at any period since the first attack; but although the vomiting and sickness were less violent and frequent, the pain and soreness of the abdomen, first complained of, never entirely subsided: she was, however, able to sit up and amuse herself with a little needlework, and to go about the domestic concerns of the family, and Mr. Chevalier had proposed to pay his final visit on the 21st. On the morning of this day she rose at ten o'clock, and within the space of an hour afterwards, whilst standing near the desk of drawers, she suddenly exclaimed, "I am dying!" She was seized with convulsions, which continued till five o'clock in the afternoon, when she expired.

On the subsequent day, Mr. Chevalier, whose anatomical skill is well known, examined the body by dissection. Neither the thoracic and abdominal viscera, nor the brain, upon the most minute examination, exhibited the least appearance of disease; in short, not the least trace could be discovered of any morbid affection.

With respect to the three other persons already mentioned to have been indisposed, the servant maid, one of them, was conveyed to her friends, and recovered. A sister-in-law of Mrs. R. also recovered; but the third, who was her mother-in-law died, after lingering under disease till March.

These circumstances having been cursorily communicated to the medical society, Dr. Adams, Dr.

Hamilton, and Mr. Lawrence, were requested to visit the house of this unfortunate family, and to endeavour to ascertain the cause of the calamity. Every culinary article, and the whole premises, were accurately examined, but without its leading to any discovery. It appeared, indeed, that Mr. R. the husband of the deceased lady, had purchased a cask of sugar at a sale, a considerable part of which had been disposed of to some friends in the country, who had used it without inconvenience, and hence no suspicion was entertained of this article having produced the fatality in Mr. R's. family.

In this state of uncertainty, Dr. Laird, another member of the medical society, visited the house; and, on examining the cask which had contained the sugar, he observed a white powder adhering to its inner surface, and which, on being heated by the blowpipe on charcoal, afforded globules of lead in the metallic state.

The mystery was thus at length developed. The sugar had been injudiciously put into a cask which had previously contained white lead. That part of the sugar which was sent into the country had probably been taken out of the middle of the cask, and had never come in contact with the lead; whilst that which was used by the family, having been taken from the side, was impregnated with this metal, and doubtless was the source of the fatal events described.

Of nine persons in this family, who were more or less indisposed, four died, and the effects of the poison appear to have been nearly in the ratio of their respective ages.

The infant, fifteen months old, was attacked and expired within the space of twenty-four hours; the child, six years of age, survived a fortnight; Mrs. R. aged forty, lingered three months before the fatal event took place; and the mother-in-law, aged sixty-seven, died four months after the attack.

The symptoms in each were very similar. The vomiting, pain in the stomach, and costiveness, mark-

ed the attack of the disease ; and the soreness of the epigastric region, in those who recovered, was not removed by medicine, but seemed rather gradually to wear away by time or change of air. The matter vomited was usually of a dark yellow colour, though sometimes green ; the fæces were in general dark-coloured ; but in the case of Mrs. R. they were completely white during the space of twenty-four hours only.

There was a considerable sameness in the medical treatment. The opiates which were given afforded no mitigation of the symptoms, unless joined with cathartics, and aided by fomentations, &c. The countenances of all the patients exhibited a pale, sickly, wan aspect. The pulse in each was slow and regular, rather indeed sluggish, and generally below the natural state ; but in no instance was there any symptoms of paralysis.*

Water impregnated with lead. Metallic lead is readily converted into the state of carbonate by the contact of ærated water, and it is on this principle that we can explain the injurious effects which are frequently produced from drinking water which has remained for some time in reservoirs of this metal, or passed through pipes of it.

Dr. Yeats, in a paper on the waters of Tunbridge Wells, mentions, that in 1815, lead colics were very frequent at that place. A Mr. Taylor had laid down, in 1814, several thousand feet of leaden pipes, to convey water to the different houses. In the following year, the lead colic occurred in those houses to which this water was distributed, and all doubt as to the existence of the poison in it, was removed by the examinations of Dr. Lambe and Mr. Brande. They detected the carbonate, in a very minute state of division, in the water.†

* Eclectic Repertory, vol. 2, p. 402—copied from the Transactions of the Medical Society of London, vol. 1, part 1.

† Brande's Journal, vol. 14, p. 352. Carbonate of lead is insoluble in ærated water. It is *diffused* through it in a very minute state of division, and is very long in subsiding. Ibid. vol. 14, p. 240.

A somewhat similar case is related of officers on board a packet bound to the East Indies. They put their allowances of water in a leaden cistern, furnished with a stop-cock, and in about three weeks, every one of them was affected with all the symptoms of colica pictonum, in the most violent degree. On arriving at St. Helena, they gradually recovered.*

These facts prove, that water resting in leaden reservoirs, cisterns or pipes, *may become impregnated with it.* And there is danger to be apprehended from its use, if the quantity suspended be sufficiently large. The exemption occasionally experienced, is to be attributed to the want of this last, and also to the circumstance that some kinds of water are unable to dissolve or suspend the lead.†

LITHARGE is another compound of lead which has occasionally proved poisonous. Sir George Baker, states, that twelve infants died successively in convulsions, at Dartmouth, (Eng.) in consequence of an ointment, which had litharge in its composition, being applied to the nipples of their nurses.‡ This substance has also been extensively used for the adulteration of wines.

Instances are also frequently given by medical writers, where the *external use* of preparations of lead,

* Medical Commentaries, vol. 19, p. 180. The presence of lead in the water was demonstrated by the application of a solution of sulphuretted hydrogen. Additional cases of the injurious effects of water impregnated with lead, may be found in the Transactions of the College of Physicians, London, vol. 2, p. 419, &c.

† In the water of the river Thames, though it flows in leaden pipes, no lead can be detected. And this may be explained by the fact, that the animal matters which constantly accumulate in it, prevent any dissolution or suspension of the metal. They combine with it, and form a bulky, insoluble precipitate. "If you add nitrate of lead to Thames water, you will find that it becomes milky, and that a white powder falls to the bottom, which dissolves without effervesence in nitric acid. It is therefore a combination of oxide of lead with some animal matter. Thus it is the impurity of Thames water, that prevents it from containing lead. Probably hard waters, containing sulphate of lime in solution, may also be free from lead. But with these exceptions, we may lay lay it down as a general fact, that all waters which pass through leaden pipes, or which are kept in leaden cisterns, contain small particles of carbonate of lead." Dr. T. Thomson Edinburgh Med. and Surg. Journ. vol. 12, p. 495.

‡ Transactions College Physicians, London, vol. 3, p. 423.

when applied to abraded surfaces, has proved deleterious.* But these are not common.

Different articles of food or drink may become contaminated with this substance.

If the *food* contain any free vegetable acids, or saline preparations, it will attack utensils made of lead, and oxidate, and indeed in some cases dissolve them. This circumstance seems to have been known to the ancients. Their tin was all adulterated with lead, and Galen, assigning this as a reason, cautions against the use of tinned vessels, and recommends the preservation of medicines in glass ones.†

Earthen vessels, glazed with lead, are also very apt to be acted on by vegetable acids. Vinegar corrodes them, and if there be any article of food within, the oxide or acetate that is produced, will mix with it.‡ So also weaker acids. A case occurred some years ago, at Northampton, Mass. where a family, consisting of eight individuals, were all seized with colic pains, strong convulsive spasms of the intestines, frequent vomitings, and obstinate costiveness, in consequence of eating stewed apples, which had been kept for some months in a large earthen vessel. On examination, the glazing was found corroded, and a solution from the stewed apples, exhibited the chemical proofs indicative of the metal.‖ Dr. Eberle also states that he saw four cases in 1815, arising from apple butter being in these vessels. On examining one

* See Med. Commentaries, vol. 3, p. 199. Orfila, vol. 1, p. 472. Percival's observations on the poison of lead.

† Beckmann on inventions, vol. 4, p. 29. The question has sometimes been asked, whether the sheet lead which is wrapped round the tea obtained from China, may not prove injurious. Dr. Thomson has satisfactorily determined this point. He found it on analysis, to consist of lead 95.5 parts, and tin 4.5 parts in the hundred. This alloy is not so liable to tarnish as pure lead, and it possesses this peculiar advantage, that when it comes in contact with articles of food, the tin is always acted upon in preference to the lead. Annals of Philosophy, vol. 4, p. 155. Proust established the fact just mentioned, by numerous experiments. See his paper on Tinning, copied from the *Journal de Physique*, in the Repertory of Arts, second series, vol. 9, p. 38 and 145.

‡ Trans. Col. Phys. London, vol. 1, p. 257, &c.

‖ "An account of the poisonous effects of the use of glazed earthen vessels, by W. Meade, Esq." New-England Journal, vol. 2, p. 258.

of them, a thin crust of acetate of lead was seen covering its internal surface.*

Milk has also acted on vessels of this description.

The adulteration of *wines* by lead appears to be an old devise, and it has been much used, since it destroys their austerity, gives them a sweet taste, and renders them saleable.

Beckmann supposes that the ancients were acquainted with the fact, that lead rendered harsh wines milder; for Pliny remarks, that when the Greek and Roman wine merchants wished to try whether their wine was spoilt, they immersed in it a plate of lead, which could only be to observe whether by corrosion the colour of the lead was changed.

It was not until the fifteenth century, that the use of lead in wines became so notorious as to call for prohibitions on the part of governments in Germany, and the adulteration of this article appears to have been a subject of deliberation at the diet of Rothenburg in 1487, and the diet of Worms in 1495.† In France, this species of villainy was carried to a great excess.

The Duke of Wirtemberg, by a decree dated March 10, 1690, declared it capital to mix litharge in wine, or even to sell litharge in the shops.‡ And individuals were punished with death for the infraction of this decree.

At the present day, we have every reason to believe that the sugar of lead is frequently employed by unprincipled dealers.‖

Cider, adulterated by lead, has also frequently proved injurious, and indeed to such an extent, that the disease known by the name of the Devonshire

* Amer. Med. Recorder, vol. 1, p. 504. See also a paper on the danger of using vessels of lead, copper or brass, in dairies, by Mr. Thomas Hayes, Surgeon, Hampstead, in the Repertory of Arts, 1st series, vol. 7, p. 116.

† Beckmann on Inventions, vol. 1, p. 396.

‡ Trans. Col. Phys. London, vol. 1, p. 346.

‖ Thirty-two cases occurred in the Duke of Newcastle's family, then in Hanover, in 1752, occasioned by their using as a common drink, a small white wine, adulterated with calces of lead. Dr. Warren, in Trans. Col. Phys. London, vol. 2, p. 86.

Colic, has been deemed to originate from this cause. I am aware that other causes have been assigned, but it is sufficient for my present purpose, that this fluid, among others, has excited the symptoms in question. And it is certainly well established, that cider boiled in leaden vessels, has produced death to those drinking it, and that the racking of it in a leaden cistern, or even the grinding of the apples in troughs which are united by lead, has been the origin of serious illness.*

Rum is also another liquor which may act on lead. Dr. John Hunter mentions, that a violent colic prevailed extensively among the soldiers at Jamaica in 1781–2. They were in the habit of drinking rum, and suspecting its purity, he was led to examine it. The result of his experiments induced him to believe that it was contaminated with lead.† Dr. Franklin also communicated a curious fact to Sir George Baker on this point. About forty years previous, (Sir George's paper was read in 1767,) leaden worms were used in Boston for the distillation of rum. The consequence was so violent to drinkers, and the illness so common, that government forbade their use, and ordered worms to be constructed of block-tin. The dry belly ache was much less heard of afterwards.‡

Even *syrups* have been clarified by the acetate of lead, and thus contain a notable portion of the metal.‖

Saturnine emanations, are well known to produce dangerous disease; and these, of course, most readily affect workers in lead, as plumbers, painters, typefounders, printers and potters. I shall not, however, enter on this subject at present, as it can hardly, if

* See the papers of Sir George Baker, and Dr. Warren, in the Trans Col. Phys. London, vols. 1, 2 & 3.

† Trans. Coll. Phys. London, vol. 3, p. 227. Med. Comment. vol. 13, p. 138. When the new rum in the West Indies, thus impregnated, has been kept in a cask for twelve months, it loses its deleterious qualities. This fact is mentioned by Mr. Sylvester, and by him applied to the discovery of a new test—the gallic acid. See Eclectic Repertory, vol. 4, p. 454

‡ Trans. Coll. Phys. London, vol. 1, p. 286.

‖ Orfila, vol. 1, p. 454.

ever, be a subject of legal investigation, and particularly because it can be examined with most advantage when we treat of the *diseases of manufacturers*, in the part relating to MEDICAL POLICE.*

It will be proper, however, to give a short sketch of the symptoms produced by the gradual introduction of small quantities of lead into the system. This will illustrate the effects of adulterated food and drink, and also those produced by emanations, or by working in the metal.

Colic is among the earliest symptoms, and from this circumstance, the complaint has been styled for a length of time, *colica pictonum*. It is not acute at first, nor of long duration, but frequently returns, and at last becomes intolerably severe. The mouth is dry, there is generally an absence of fever; sickness of the stomach is present, and sometimes vomiting, which will last for several days. The abdomen is drawn inwards towards the navel, and this sinking in is the more observable, as the pain becomes more intense. Costiveness is very common, and the alvine excretions are discharged with pain and difficulty. The urine presents no particular character.

Paralysis of the fingers, hands and wrists, is also a frequent accompaniment of this disease, and it occurs most severely in those who are in the constant practice of handling preparations of lead. Convulsive motions, prostration of strength, a dry cough, and a gradual wasting, generally attend this stage of the complaint.

It has been observed by some writers, that the appearances found on dissection in those who have fallen victims to saturnine emanations, are strongly indicative of disease—exhibiting inflammation or ob-

* The following, however, deserves quotation in this place. It is extracted from the late work of Dr. Cooke on palsy. "Dr. Cooke was consulted by a gentleman who had a paralytic affection of one side of his face, without any assignable cause. On inquiry, however, it was found that he had slept two or three nights in a room where the bed was placed near a closet, the door of which had been recently painted what is called a dead white." Medico-Chirurg. Review, vol. 1, p. 736, Amer. ed.

struction of the mesentery and its glands—affections of the liver, spleen and lungs—and inflammation of the intestines. Most of these are, however, contradicted by modern examiners, and it is denied, that in general any inflammation is found in the digestive canal. A contraction of the diameter of the great intestines, particularly of the colon, is the only morbid appearance that was observed in numerous dissections.*

Chemical proofs.

Acetate of lead. *(a)* Sulphuric acid poured on it, decomposes this salt, and gives a white precipitate of sulphate of lead, while the acetic acid is set at liberty, and may be detected by the smell.

(*b*) Sulphuretted hydrogen, and the hydro-sulphurets, immediately blacken the solution of the acetate of lead, and throw down a black sulphuret.

(*c*) The sub-carbonate of soda instantly decomposes it, and precipitates from it protoxyd of lead, combined with carbonic acid. It is of a white colour. This test is much more exact than the former in detecting minute quantities. One drop of the solution of the acetate of lead, diluted with three ounces of distilled water, was immediately rendered turbid by a few drops of a solution of the sub-carbonate of soda. The hydro-sulphurets produced no effect on the same quantity. The white precipitate thus obtained, on being treated with sulphuretted water, turns black.

(*d*) Sulphate of soda gives a white precipitate. This is also a very minute test.

(*e*) Ammonia produces a white precipitate, which when washed and dried, acquires a yellowish tinge.

(*f*) Chromic acid and the chromate of potash produce a beautiful canary yellow precipitate.

(*g*) Muriatic acid and the muriates, a white precipitate.

(*h*) A plate of zinc immersed in the solution, becomes covered with a black coat, on which are soon

* Orfila, vol. 1, p. 476.

perceived some small scales of lead, extremely brilliant.

(*i*) The infusion of galls gives a yellowish white precipitate. Gallic acid, in a pure state, is recommended by Mr. Sylvester as a very delicate test; it causes a similar precipitate.*

(*k*) If the precipitates be dried, or the suspected substance be in powder, they may each of them be united with potash and charcoal, and exposed to heat in a crucible. If lead be actually present, it will be found in a metallic state after the process.

This mode of detection applies equally to all the oxides of lead, as litharge and minium. On being calcined with charcoal, they become decomposed, and furnish carbonic acid gas and metallic lead.

The action of animal and vegetable fluids on the acetate of lead, must also be mentioned. A strong infusion of tea produced a yellowish white precipitate. Burgundy wine decomposes the solution, and the mixture thus obtained, produces the characteristic tests of acetate of lead, with the sulphuric and chromic acid, the hydro-sulphurets, the sub-carbonate of soda, and zinc. Ammonia, however, produces a dirty yellow turbidness, instead of a white precipitate, and it is therefore not to be depended on in testing adulterated wines. Albumen produces an abundant white precipitate. Gelatine does not affect it, while milk and bile are copiously coagulated by it.†

For the detection of lead in wines, a test invented by Dr. Hahnemann, and known by the title of *Hahnemann's wine test*, has also been recommended. It is prepared by putting together into a small phial, sixteen grains of sulphuret of lime, prepared in the dry way, and twenty grains of cream of tartar. The phial is to be filled with water, well corked, and occasionally shaken for the space of ten minutes. When the powder has subsided, decant the clear liquor, and preserve it in a well-stopped bottle for use.

* Eclectic Repertory, vol. 4, p. 454, from Nicholson's Journal.
† Orfila, vol. 1, p. 448 to 450.

This liquor, when fresh prepared, discovers lead by a dark-coloured precipitate.*

Antidotes. From the experiments of Orfila it appears, that the sulphates of soda and magnesia are the most useful remedies against the noxious effects of the salts of lead. They decompose the acetate in particular, and transform it into an insoluble sulphate of lead, which Orfila considers innoxious. He recommends the same treatment for the other preparations. We should aid their operation by diluents and purgatives, and prevent any tendency to inflammation by the antiphlogistic treatment.

The treatment of colica pictonum, does not require a notice in this place.

The sulphuret of potash should never be administered as an antidote, since it is (as we shall hereafter shew) itself a poison.

Having concluded our examination of the older metals and their compounds, as instruments of poison, we shall now briefly notice two other simple bodies, which have been made the subject of experiment by Orfila.

Phosphorus, when dissolved in oil and injected into the jugular vein, instantly produced copious exhalations of phosphorous acid. The respirtaion was difficult and panting, and considerable quantity of a bloody serosity was thrown up, and death followed in twenty minutes after the injection. The lungs, on dissection exhibited several livid and dense portions; the stomach was natural, and the left ventricle of the heart contained blood as black and fluid as that which filled the right. When phosphorus is introduced in small lumps into the stomach, it does not at first induce any remarkable effect, but the animal falls gradually into a state of depression and dies. The stomach is much inflamed, and contains a thick greenish fluid. In an experiment where our author ad-

* Henry's Chemistry, vol. 2, p. 275. Orfila, in his Directions, gives minute directions for the detection of lead in wines. They are, however, merely repetitions of the tests stated above.

ministered one hundred and forty grains in small lumps to a dog, one hundred and twenty-seven only were found after death, in various parts of the intestines.

The action of this substance is infinitely more violent, when it is introduced into the stomach, in a state of solution with oil. Fumes of phosphorous acid were exhaled from the lungs, and the subject seemed to suffer exquisite torture. It then lay immovable, but about six minutes before he expired, general and violent convulsions occurred. The stomach was corroded in three places, and the mucous membrane where it had not been perforated, was reduced to a stringy kind of pulp. The lungs were red, distended with blood, and did not crepitate.

Treatment. As inflammation is evidently the consequence of the exhibition of phosphorus, we should of course use the appropriate remedies for removing it. An emetic must be premised to remove, if possible, the poisonous ingredient, and water containing magnesia in a state of suspension, is also advised, as tending to fill the stomach with fluid, and at the same time neutralizing the acid that is forming.*

Iodine. Orfila is the first who tried any experiments with this substance. He found that dogs, if they vomited freely, survived, although they had taken a drachm and upwards of it, but when this did not occur, or if the œsophagus was tied, it invariably proved fatal, after exciting violent efforts to vomit, hiccup, thirst, quick pulse and great depression. The mucous membrane of the stomach was always found corroded and ulcerated, but the lungs and other organs were natural.

Our author was able in some cases to detect the iodine in the matter vomited and passed by stool. On drying and exposing it to heat, the violet coloured vapour appeared.

* Orfila, vol. 1, p. 405 to 414. It is stated by Dr. Thomson, that if phosphorus be allowed to stand in water for some time, it will render that fluid poisonous to animals that drink it. Annals, vol. 16, p. 232.

A drachm and twelve grains were sprinkled on a wound on the back of a dog. The skin immediately grew yellow, and in three days, an eschar formed, leaving the subjacent parts highly inflamed. The animal however recovered.

Our author next ascertained the effect of iodine on the human subject. He himself took two grains fasting, but they only excited an abominable taste, and nausea. The next morning, he took four grains. He was immediately sensible of constriction and heat in the throat, which continued a quarter of an hour, and he soon vomited yellow liquid matter, in which iodine was readily discovered. Two days after he took six grains, which instantly excited heat and constriction of the throat, nausea, irritation, salivation and pain of stomach, and in ten minutes, copious bilious vomitings and slight colic pains, which yielded to two emollient enemata, after having continued an hour. The pulse rose from 70 to 90 and was fuller. The next day he felt only a slight fatigue.*

THE ACIDS.

Sulphuric acid. That this substance should sometimes be the cause of death, may readily be conjectured, but it requires some acquaintance with human folly and wickedness, to believe that it could be thought of, as the instrument of suicide, and even of murder. Such is however, too certainly the fact.†

* Orfila, vol. 1, p. 490. Dr. Coindet, of Geneva, has lately exhibited this substance in bronchocele. His prescription is thirty-six grains of the hydroiodate of potash, and ten grains of iodine dissolved in an ounce of distilled water. From six to ten drops are at first prescribed three times a day, and the dose is increased or diminished according to the effects produced. The following symptoms have been occasionally observed by him from its use. "Acceleration of the pulse, palpitation, dry cough, watchfulness, marasmus and prostration of strength;—sometimes swelling of the legs, tremors, painful hardness of the bronchocele, diminution of the breasts or a remarkable augmentation of appetite supervene; and he adds, that in almost all the instances which he has observed, to the number of five or six, a very rapid diminution, or a disappearance more or less complete has taken place during these symptoms, even in hard, bulky and old bronchoceles." Quarterly Journ. Foreign Med. and Surg. vol. 3, p. 348.

† In January, 1808, a female was tried and convicted at Edinburgh, for the murder of her natural child, aged eighteen months. It was proved

The following are some cases illustrative of its effects :

Joseph Parangue, a soldier, about the end of January, 1798, between seven and eight in the morning, swallowed by mistake, a glass of sulphuric acid, imagining it to be brandy. He drank if off at once, with his head back, and poured it from a distance into his mouth. By this means, he did not discover his mistake until he drew his breath. He was instantly conveyed to the hospital, and Dr. Desgranges being at hand, he immediately saw him. Excessive vomiting, convulsive agitations of the muscles of the face, violent cramp in the stomach, and an acrid burning heat in the throat and œsophagus were present. The body was icy cold ; the pulse small, concentrated and irregular, and the breathing difficult. The carbonate of magnesia suspended in water, was administered with considerable relief; and although vomiting returned once, yet by the continuance of this remedy, the anxiety and pain diminished, the pulse rose, and a genial heat was diffused over the body. The antiphlogistic regimen and diluents were subsequently required to remove the consequences of this potation. The whole of the mouth and throat was found on the subsequent day, excoriated and covered with eschars, the epiglottis swelled, and on the fourth day, a slough from the uvula, almost threatened suffocation. This gradually came away and he finally recovered, but a painful sensibility of the throat and stomach remained for a length of time, especially when he ate hastily, or used food that was indigestible.*

A female swallowed some for the purpose of destroying herself, and in four hours thereafter was brought to the Hotel Dieu. Pain, coldness of the skin, constipation and inquietude were present, with

that she had poured a quantity of oil of vitriol down its throat, pretending that she was giving it raw sugar. Violent retchings and vomiting immediately ensued, and it died in a few hours. Edinburgh Annual Register, vol. 1, part 2, page 4.

† Orfila, vol. 1, p. 315. Foderè, vol. 4, p. 96.

copious and repeated vomitings of a deep blue coloured and glairy fluid. Proper remedies were given, but the symptoms increased in severity. On the second day, the face appeared greatly deranged, the cold on the surface increased, the pulse became insensible in the wrists, and carotids ; the breath was extremely fœtid ; a few drops of very high coloured urine escaped from time to time, and the disquietude and agitation were extreme. She could not bear any kind of covering, and the region of the stomach was exquisitely sensible to the slightest touch. On the fourth day, she was incapable of resting a single instant in the same position, and rose up, for the purpose of going to a cold place. Death finally relieved her on the fifth day, and she preserved her reason to the last.*

In one case quoted from Tulpius, a miliary eruption appeared over the whole body, in addition to the ordinary symptoms.

Its effects on an infant are illustrated by an instance that occurred to Dr. Bateman. A mother, by mistake, administered about a teaspoonful to her child, aged two and a half years. This was at half past four, P. M. She immediately excited vomiting by putting her finger in the child's throat, and the matter brought up resembled coffee grounds. It seemed to suffer little pain except when vomiting, which occasioned crying, and it died easily, and almost unperceived, at nine the same evening.†

These cases (particularly the first and second) give a full view of the symptoms ordinarily observed, and it is therefore not necessary to repeat them.

Appearances on dissection. In the case of the female related by Tartra, the abdominal viscera were for the most part œdematous, and the coats of the duodenum were in several points nearly dissolved. The stomach externally showed great distention, was

* Orfila, vol. 1, p. 320, quoted from Tartra.
† Edinburgh Med. and Surg. Journal, vol. 10, p. 257

of a dark colour, and exhibited several spots indicative of deep disorganization. The mucous membrane of the œsophagus was burnt, blackish and partly detached. The stomach contained a dark and very fœtid fluid, similar to what she had vomited, and it was much thickened in some points, and corroded in others. The internal coat was entirely dissolved, and reduced to a state of mucus throughout the greatest part of its extent. The pylorus presented the most decided marks of disorganization; its coats were black and puffed up, and almost closed the orifice. The duodenum and jejunum were partly destroyed and burnt, and attacked with sphacelus, and the whole of the intestinal canal partook more or less of the injury.

In Dr. Bateman's case, the omentum was seen converted into a black pulpy mass, but still possessing sufficient tenacity to retain the food which had escaped from the stomach. There was also in the omentum a small quantity of dark-coloured fluid, similar to what had been vomited. In the stomach, there was an erosion or aperture about three inches in diameter, bordered by thickened edges of a dark-brown cinder-like appearance. The œsophagus, with the exception of a slight purple blush, showed no marks of disease. There was an appearance of inflammation towards the cardia, but none towards the pylorus. The intestines were free from inflammation, although they were strongly marked with transverse corrugated rings.*

* Two additional cases of poisoning with sulphuric acid, (one an act of suicide, and the other accidental,) are quoted from a German journal in the London Med. Repository, vol. 14, p. 160. Death ensued in the first case after a few hours. On dissection, the cranium, lungs and pericardium, were generally healthy. The œsophagus was internally whitish, and the shrivelled epidermis but loosely connected with the subjacent muscles. —the diaphragm brownish, very soft, and in some places much corroded— the omentum nearly destroyed. The stomach of a dirty brown colour, tore on the slightest touch; contained fluid of a sourish and somewhat cadaverous smell, and brown colour, and mixed with white caseous matter, and blackish coagulated blood.

This fluid was passed through filtering paper, and then imparted a red colour to litmus paper. A solution of muriate of barytes dropped into an-

In what may be styled a chronic case, where a quack had administered some sulphuric acid and oil, difficulty of drinking, speaking, and even breathing, occurred during life. The deglutition of fluids was impracticable, and an elastic gum sound was introduced, in order to enable the patient to take a little nourishment. This gave present relief, but in a short time she became unable to bear its introduction, and was reduced to chew watery vegetables to quench her thirst. The smallest quantity of fluid threatened immediate death. Debility, marasmus and œdema, soon followed, and she finally expired at the end of several months after taking the mixture.

other portion, produced a white precipitate, which was wholly soluble in pure nitric acid; and hence sulphate of barytes. To a third portion was added a solution of nitrate of lead; from this immediately resulted a white precipitate, again soluble in the supernatant liquid. Consequently, as demonstrating sulphate of lead, it confirmed the evidence of the first experiment, and clearly proved the presence of sulphuric acid in the contents of the stomach.

The coats of the organ itself were scarcely recognizable; in some places very thick, with coagulated blood extravasated between them; in others dark brown, much corroded, exhibiting as it were gangrenous spots; and their whole substance extremely soft and lacerable. The internal membrane of the small intestines shrivelled, and the valvulæ conniventes projecting one on the other, so as to close the whole canal. The mucous coat of the large intestine also white and wrinkled up, but otherwise unaltered. Pancreas sound. Liver externally discoloured; every where very firm and compact; its external surface cutting like leather to the depth of some lines, and of a brown colour; internal structure bright red. Gall-bladder, its membranes considerably thickened, containing a thin and almost colourless fluid, and bright yellow bile strongly adherent to the blood-vessels, which projected on its internal surface. Spleen firmer than natural, and resembling on incision, the liver. The kidneys, except that they presented a leather-like surface, unaltered. Urinary bladder empty.

The second case is peculiarly interesting, as the patient survived two months. On examination, the body was so emaciated, that "the cellular membrane, in the intervals of the muscles, appeared quite empty, and the muscles themselves projected distinctly beneath the skin. The bones, with all their prominences, perfectly visible. The teeth firm; gums of a pale blue colour; tongue yellowish white; nostrils dry, and widely dilated. The belly so sunk in, that its parietes seemed completely drawn together, and the navel to rest upon the spine. Anus closed. Livid specks observed on the inguinal region only. No trace of external injury.—*Abdomen* Adipose substance completely absorbed. Omentum merely a delicate transparent membrane, interwoven with vessels. Liver uncommonly small, of a dark-brown red colour. Gall-bladder distended with bile. Spleen of a bright blue or lead colour. Transverse colon low down; and greatest portion of the small intestines deeper than usual in the pelvis A the parts in the vicinity of the gall-bladder, the peritonæum and muscles, of a dark-brown colour. No traces of inflammation. The stomach was so contracted as to measure but five inches long and three deep. Its membranes

On dissection, the sole lesion observed, was a hardening of the epiglottis, in consequence of which, it did not close more than half of the glottis.*

Effect on animals. It would certainly seem unnecessary to ascertain the effects of the injection of sulphuric acid into the veins, since, so far as I can ascertain, no practical purpose is to be gained by it.† Orfila has however instituted some experiments in this way. It caused instant death, by coagulating the blood. When introduced into the stomach, it killed by the inflammation and disorganization of that organ, and when applied to the skin, by the burn that it produced, or the suppuration of which it was the consequence.

The other acids (nitric, muriatic, phosphoric, fluoric, &c.) acted in a similar manner. It will therefore not be necessary to notice this head again, unless there is something peculiar to be mentioned.

Chemical proofs. These will afford but little aid,

every where, but especially in the vicinity of the cardia and pylorus, considerably thickened; the orifice of the latter scarcely four lines wide, but its circumference thickened, and of cartilaginous hardness. On the villous coat of the organ, and near the pylorus, several small, red, firm, granulated spots, with elevated margins, which had the aspect of incipient carcinoma, and evidently indicated the operation of a corrosive fluid. In the pylorus itself, cardia, and great curvature of the stomach, similar spots; but those in the two latter situations smaller, and less red. One in the fundus of the organ, of a greenish-blue colour, and two inches in circumference, exhibiting several small vessels much gorged with blood. A bluish patch on the external surface corresponding to it. The duodenum in the same state as the stomach, but more strongly marked, the nearer it approached that organ. The villous coat of the small intestines exhibiting very firm wrinkles, disposed in rows. Membranes of jejunum and inferior portion of ileon extenuated; their blood-vessels, as it were, injected, and villous coat much wrinkled. Large intestines displaying these changes in the slightest degree, and containing some bright-yellow excrement. Kidneys firm and small. Bladder empty and contracted, Gall-bladder affording a considerable quantity of dark-green thick bile.—*Thorax.* Lungs collapsed, marbled with red and blue. Pericardium very firm, and containing a quantity of fluid. Heart large; little blood in the ventricles, especially the left; auricles empty. Œsophagus thickened, but without inflammation or corrosion.—*Cranium.* Clear lymph beneath the dura mater, diffused over the whole brain. The same, coagulated, beneath the tunica arachnoidea, and all the cerebral vessels much gorged. Small quantity of fluid in the lateral ventricles. Basis of brain natural."

* Pelletan, vol. I. p. 19.

† And particularly as Fracassati performed the same experiments, with similar results, one hundred and fifty years ago. See Phil. Trans. vol. 2, p. 490.

since the sulphuric acid can seldom be obtained in a liquid form from the stomach after death. Should its presence however, be suspected in the fluids vomited, we may treat it with carbonate of lime. This causes an effervescence, and the production of sulphate of lime. Barytic water and nitrate of lead when added, also yield a white precipitate, consisting of the respective sulphates, whose character must be ascertained by their appropriate tests. Our main reliance for proofs must be on the symptoms and the appearances on dissection. And if any remains of the poison can be found and identified, we may ascertain its nature by means which are familiar to every chemical student.

Some of the succeeding results may tend to elucidate the phœnomena found on dissection.

Syrups and tea are not affected by the sulphuric acid. It brightens the colour of wine. Gelatine becomes more limpid with it, but albumen is copiously precipitated of a white colour. Milk is instantly curdled. One or two drops poured on human bile, causes a beautiful precipitate of a yellow colour, and this appearance is sometimes seen on dissection in the duodenum from the above cause. Lastly, when mixed with fluid blood, it coagulates and decomposes it, and if the acid is concentrated, it turns it to a deep brown and carbonizes it.*

Treatment. Water containing calcined magnesia in suspension, must be instantly administered, or if this cannot be procured, soap and water or chalk and water. The caustic must thus be neutralized, or the patient is lost. The subsequent treatment must depend on the degree of inflammation present.

NITRIC ACID. We are indebted to Dr. Tartra of Paris, for an able and comprehensive essay on this

* Orfila, vol. 1, p. 310, 311. It is also proper to immerse portions of animal flesh in sulphuric acid, and observe whether their appearance resembles that found on the dead body. This was the mode pursued by Dr. Bateman, and with a satisfactory result. The *black colour and pulpy consistence* were not produced by other caustics. Edin. Med. and Surg. Jour. vol. 10, p. 257.

substance as a poison. And from the extracts given by Orfila, and a most instructive analysis contained in the Edinburgh Medical and Surgical Journal, I have taken the following particulars.*

Dr. Tartra arranges the cases of poisoning by nitric acid into four classes. "1. When the death is speedy, for it is never sudden. It commonly takes place from the primary effects in about twenty-four hours, varying from six to forty-eight hours. 2. When it proves fatal from its secondary effects, at various distances of time, from fifteen days to some years. 3. When death does not take place, but the recovery is imperfect. 4. When a perfect cure is sooner or later obtained.

1. The following example will give a tolerable idea of the progress of the symptoms in the first case. A man driven by distress to commit suicide, under the greatest agitation of mind, and upon an empty stomach, swallowed at a draught, two ounces of concentrated nitric acid. Instantly he was seized with the most excruciating pains and agitations, and could not lie in bed, but rolled himself upon the floor. Vomiting came on, accompanied by general sensation of coldness, especially in the extremities. Every time he vomited, the matter effervesced upon the pavement. He got a solution of soap and oil. In two hours he was brought to the hospital; and upon the road he frequently vomited and stopped to drink. On his arrival, he got emollient drinks, especially linseed tea, in great abundance. He was in continual agitation, and his countenance very much altered. He vomited every instant a blackish glairy matter. He opened his mouth easily, and his tongue was white, with a tinge of yellow. He had acute pains in his mouth, along the œsophagus, and in his stomach. His belly slightly tense, could not bear the slightest pressure, it so excessively augmented his pains. The surface of

* Orfila, vol. 1, p. 329 to 360; vol. 2, p. 560. Edin. Med. and Surg. Jour. vol. 9, p. 369. Review of "*Traitè de l'empoisonnement par l'acide nitrique*, par A. E. Tartra, medicin. Paris, 1802."

his body was cold; his pulse small, concentrated and frequent; he had hiccup, and his respiration was laborious. His symptoms increased. He uttered sighs and lamentations. His limbs became icy; a cold sweat covered his whole body; his pulse was almost imperceptible, and the pain was constant. Still he could rise, and make continual and useless efforts to quench his thirst, and satisfy his urgent desire to make water and go to stool. He continued in this state during the night. The matter vomited became more clear, and of a yellow colour. He at last made a few drops of urine. The shocking appearance of his body already resembled that of a corpse, but he retained his senses, and was speaking when he expired, nineteen hours after swallowing the acid.

The burning heat and pains which are commonly the immediate effects of nitric acid, when swallowed, present striking contrasts. In general, they are not in proportion to the quantity or strength of the acid swallowed. Often, persons who have taken only a small dose, are seized with the most excruciating and dreadful pains, and some of those who have swallowed a great quantity, two or three ounces for example, have had scarcely any suffering, but remained very tranquil. In the first case, the patients either recover or survive a long time. In the second, speedy death is almost always the consequence. Thus a young man of twenty died in twenty hours, without any agitation or signs of acute pain. On opening the body, the highest degree of disorganization appeared, perforations of the stomach, and great effusion of its contents into the abdomen.

A woman said she had taken nitric acid, but she seemed so little affected by it, that many thought she was imposing on them. There was no agitation, no pains or vomiting, but the smallness of the pulse, lassitude and prostration of strength, rather indicated a typhus fever. Next day she died; and on examining the body, there was found the greatest degree of disorganization that nitric acid is capable of producing.

perforation of stomach, gangrenous spots, effusion into the abdomen, marked corrosion of all the viscera, and general yellow colour.

But when the acid, from deficient quantity or strength, only acts on the mucous membranes, then it does not always prove fatal; but the pains are excessive, the colic dreadful. In the one case, the sensibility seems to be annihilated: in the other, excited in the highest degree. Here, as on many other occasions, the pain is to a certain degree proportionate to the severity of the affection, but after a certain point it seems rather to be in an inverse ratio.

In fifty-six cases, death from the primary effects took place in nineteen.

2. The second variety of the progress and termination of poisoning by nitric acid, exhibits at first, the same phenomenon as the preceding. But less alarming symptoms succeed by degrees, anxiety, irregular fever, dryness of the skin, spasmodic constriction of the extremities, wandering vague pains, deep and difficult inspirations, dryness of the tongue and throat, excessive thirst, deep pain in the region of the stomach, habitual tension of the abdomen, obstinate costiveness, vomiting less frequent, a kind of copious salivation, uneasiness in the throat from the imperfect detachment of the flakes of the membrane lining it, portions of it still partially adhering, frequently floating in the pharynx, and disturbing both respiration and deglutition.

The pulse is often miserable, and the slow fever has no remission; the cold continues over the surface of the body, and there are irregular fits of shivering occasionally. Every kind of food, solid or liquid, is vomited. Milk alone seems to agree with the stomach. After some time, the inner membrane of the alimentary canal detaches itself in portions, which are discharged by vomiting, with floods of frothy and intolerably fœtid saliva. Membranous flakes, swelled, rotten, and often of a very great size, are frequently pulled out of the mouth. This state lasts, in

some cases, only about a fortnight, generally several months, and occasionally for years. But these persons uniformly fall into complete marasmus. Digestion is totally deranged. The stomach can bear no kind of food. All the functions languish.

The constipation increased to such a degree, that whole months pass without a single alvine evacuation. These invalids will go to the close-stool twenty times a day, to satisfy their urgent desire to have a stool, and in the course of three months, only pass once or twice small masses of feculent matter, formed like pills, of a few grains in weight. Injections are of no use, but are frequently retained, and sometimes do harm.

Instead of amending, their situation grows daily worse. Insupportable to themselves, inconstant and impatient, they seek in vain for relief. Emaciated in the greatest degree, they resemble walking skeletons. Their whole appearance is revolting—spitting every instant, vomiting continually, or their lips and chin covered with filthy putrid saliva. It is difficult to conceive, how the exfoliation of the œsophagus and stomach can furnish such a quantity of eschars as are discharged by vomiting, and in some few cases by stool during whole months. Nothing can exceed the intolerable fœtor of these putrified membranous flakes. Sometimes when discharged by the mouth in small quantity, they form portions of hollow cylinders, detached from the entire circumference of a part or the whole of the œsophagus, and in some rare cases, where the whole internal membrane of the œsophagus and stomach has been but slightly and uniformly affected, the whole exfoliates at once, and even in a single piece, threatening instant suffocation. Digestion being completely suspended, the system seems to live upon itself, as if the organs of secondary importance to life were absorbed, to nourish those indispensable to its continuance.

The muscles are considerably reduced in bulk, the cellular membrane is every where sunk, the adipose

system entirely disappears, and the integuments are glued upon the bones, exhibiting their rudest forms. The skin becomes dry, scaly, and almost dead and inert, as in extreme old age. The physical faculties are extinct, and the moral faculties are singularly decayed. There remains only their shadow, as it were. The ravages, which in the course of nature, ought to be the progressive effects of many years, are completed in a few months. Every thing in these individuals, presents the picture of accidental and premature old age. The individual still lives, but is only separated by an imperceptible interval from death which encroaches daily upon the province of life. A certain activity of the animal life still remains, when the organic, remarkably reduced and decayed, is just about to cease.

This variety of the progress and termination of the disease, induced by swallowing nitrous acid, is not uncommon. It took place in *seven* of the *twenty-nine* cases now first described by Dr. Tartra, and he accounts plausibly enough for its having been seldom observed before, by supposing, that when persons who had swallowed nitric acid, had got the better of the primary symptoms, they were lost sight of, and the subsequent affection was not imputed to the proper cause.

Such in general is the progress, when patients die of the secondary symptoms; but in the case of a female it was considerably different, as well as the appearances on dissection. The constipation was not very great; the expectoration did not last long, and the vomiting was rare; but a fixed pain at the bottom of the thorax, accompanied by difficulty of breathing, and spitting of blood, deceived the medical attendants who were not acquainted with the fact of her having drunk nitrous acid. She was treated as if for pectoral complaints, and died in about sixty days after having swallowed the poison.

In this case alone, the body was not remarkably emaciated. The stomach was only a little contracted

and adhered in several places, especially to the liver and spleen. It contained a mass of solid blood, of a dark red colour, the size of a fist, moulded to the shape of the stomach, and covered by a very fine membrane, which seemed to be either the mucous membrane detached from the stomach, in several places, or perhaps a membrane of new formation. The intestinal canal, in this case, was of the usual size. Death seemed to have taken place before the gradual consumption had wasted the body.

3. The third variety of termination is in imperfect recovery. This is also very frequent, and is characterized by the same train of symptoms with what we have now described, but very inferior in degree. The exfoliation of the œsophagus and stomach, either takes place but once or only a few times. A slow and progressive amendment ensures the safety of the patient. But there still remains some complaint: obscure pains in the throat, and especially in the epigastric region; habitual constipation, occasional vomiting, and increased sensibility of the stomach, so that that organ can only support light nourishment and bland liquors. In short, they continue invalids during the rest of their lives; they are subject to repeated and even habitual indispositions, and sometimes to pain and insupportable heat of the stomach. But they are able to follow their occupations and long survive their poisoning. Dr. Tartra has met with *eight* examples of this termination of the disease, in fifty-six cases.

4. The total disappearance of the symptoms produced by swallowing nitric acid, or complete and absolute recovery without leaving any consequences, is the last variety of termination. Of fifty-six cases, the recovery seemed to be complete in *twenty-one*.

Appearances on dissection. When the patients die of the primary effects of nitric acid, the external appearance of the body presents no alteration; every part is sound and natural, and presents in a certain degree the firmness and freshness of life. The epi-

dermis of the margins of the lips has commonly an orange colour, more or less deep. It seems burnt, and separates very easily. Sometimes yellow spots are discovered on the hands and other parts of the body, caused by the contact of nitrous acid. A yellow fluid, in some cases very abundant, flows from the mouth and nostrils, and the belly is considerably distended with air.

The alimentary canal is remarkably affected. All the internal membrane of the mouth is burnt, and has sometimes a white, but more commonly a yellow colour. It is separate in some places, and adheres in others. The teeth are often loose, and have a very marked yellow colour at their crown. The mucous membrane of the pharynx exhibits the same change, or is in a state of inflammation of a dirty red colour. The whole extent of the œsophagus is lined with a dense mass of a fine yellow colour, dry on its surface, unctuous and greasy to the touch, and which seems to be formed both of the mucous membrane, altered in a particular manner, and of the albumen contained in the viscid fluid which exudes from the membrane of the œsophagus, solidified by the nitrous acid. This lining adheres in very few points, and is easily detached from the other membranes of the œsophagus, which are brown and blood-shot.

When the stomach is not perforated, it has commonly a considerable size. Externally, its membranes are slightly and partially inflamed, but very much towards the pylorus, and beginning of the duodenum. Its colour is faded, livid, of a yellowish green, with large gangrenous spots. It adheres every where to the neighbouring parts, the diaphragm, liver, spleen, and transverse arch of the colon, by means of a concrete lymphatic exudation. Its sides, which are thin and yellow in some places, and thick and black in others, exhibit networks of dilated blood vessels, filled with black coagulated blood. Often there are several points of the stomach dissolved, and ready to burst with the slightest touch. It contains

a great quantity of gas, which has a particular smell, resembling that of bitter almonds. Most commonly, it also contains a great quantity of yellow matter, having the consistence of pap, in which there are flocculi, or small masses resembling tallow, which, however, may be the cheesy part of the milk drunk by the patient, decomposed in the stomach. Its sides are coated internally with a thick grained paste, of a yellowish green colour, composed, according to all appearance, of the internal membrane, disorganized and dissolved, and of coagulated albumen Almost always the substance of the stomach is swelled in some places, and deeply marked with black, without being dissolved. This effect is most remarkable at the great end, into which the acid seems to fall by its weight. The rugæ of the stomach are very brown, and are reduced to mucilage. They are easily removed by the finger from the nervous coat, which, by reason of its whiteness, often appears in a great measure sound. The small end is affected with many deep spots of gangrene, and the pylorus is much contracted.

The duodenum internally, especially at its two curvatures, presents the same kind of change as the stomach. Its sides, as well as those of the jejunum, are marked with yellow, slightly greenish. They are also lined with a very thick orange crust, and the villous membrane is dissolved and destroyed. These phenomena have less intensity in proportion as the part is more distant from the stomach.

The surface of all the abdominal viscera is commonly very much inflamed. The peritonæum is thickened, hard, of a dirty red, covered with albuminous layers, which unite, by numerous adhesions, all the viscera, and especially the folds of the intestines, as it were into a single mass.

The thoracic surface of the diaphragm, and of the inferior lobes of the lungs, is covered with a very solid layer of albumen, of a whitish colour.

A bloody liquid is effused into the abdomen; there is also a small quantity in the chest.

The urinary bladder contains no urine, although the patients have not discharged any. The large intestines are usually filled with very hard fæces.

In most cases where the stomach is perforated, its bulk is very small; in other respects it is the same. The holes commonly occur in the large and small extremities: their form is circular, and their edges thin and as if dissolved. We then find in the abdomen an enormous effusion of a thick yellow liquid, containing many white flocculi, and resembling the fluid with which the stomach is filled, when it is not perforated. The greatest distention always accompanies this state of the belly. The alteration and disorganization are carried to the highest degree. The surface of the abdominal viscera seems to have suffered the direct action of very dilute nitric acid. It is greasy and unctuous to the touch, and almost every where spotted with yellow.

The appearances upon dissection of those who die of the secondary effects, are entirely different from those now described. It would be difficult to find an example of greater emaciation, more advanced consumption, or disgusting form. Nothing is equal to the degree of withering, drying up and decrepitude of the whole organs. Their colour is faded; the internal cavities do not contain the usual serum; the cellular and muscular systems are almost annihilated; the bones become dry, as in persons of advanced age, and break with wonderful facility. But these changes are general and secondary, and depend upon local organic derangement of the alimentary tube. The stomach and whole intestinal canal are contracted to an extremely small size, so that they could be contained in the hollow of the hand. The intestines are not larger than the little finger, sometimes not exceeding a thick writing-quill. Their coats are very thick, their cavity almost obliterated, and containing only a little mucosity. In general, all the parts touched by the poison are contracted, and as if obliterated. The stomach, which often resembles a por-

tion of a small intestine, appears sound externally, and only presents some adhesions to the diaphragm, liver and spleen; internally, the most remarkable change is, the contraction of the pylorus, the passage through which, is not larger than a lentil, or even scarcely admits a probe; and the membranes of the stomach itself are so thickened and compacted around it, that they have lost all their natural suppleness.

On the internal surface, there are irregular spots, or rather smooth and red places, which seem to be covered with a regenerated mucous membrane, less villous than that which has been destroyed by the action of the acid. These cicatrices are especially large and numerous in the great end of the stomach and around the circumference of the pylorus. There are also commonly some at the cardia, as well as in the lower half, and even the whole of the æsophagus and pharynx. The adhesions of the stomach with the neighbouring parts are sometimes simple, but most commonly they are very remarkable. Viewed from the inside of the stomach, they form irregular, circular depressions, where the whole thickness of the coat is evidently wanting, so that in attempting to destroy these adhesions, we find that there are in fact so many holes through the substance of the stomach, which are plugged up by the adhesion of the neighbouring viscera."

Chemical proofs. The usual effects of alkalies and earths on this acid, are too well known to need repetition in this place. We shall hence only mention its operation on animal and vegetable fluids. Syrup and gelatine are not disturbed by it. The colour of tea is heightened by its addition, and Burgundy wine acquires a redder colour. When added to albumen, a white precipitate is abundantly produced, which after some time becomes yellow; and if this yellow mass be washed and dried, and afterwards boiled with a solution of pure potash, the liquor will at once become of a rich red colour, and will furnish, by evaporation, a brown-red mass, com-

posed of animal matter, *nitrate of potash*, and the excess of the alkali employed. Milk mixed with this acid, is instantly coagulated, and throws down white curds, which quickly change to yellow. Human bile brought in contact with two drops of it, gives an abundant precipitate of the *yellow matter*, which acquires a *green* colour by the addition of a fresh quantity of acid, and in the end becomes of a brick-red, when a great quantity of acid is employed. Fluid blood is instantly coagulated.

If the remainder of the poison can be procured, we should unite it with copper filings, when nitrous gas will be evolved, and the blue nitrate of copper formed—also with pure potash, as above directed. On the patient, whether living or dead, we are to notice whether any orange-coloured spots are present, either on the face, hands, lips, or mouth; and in the latter case, if the fluids vomited, or found, do not afford any satisfactory explanation, we must collect the flaky and solid substances. These are to be boiled for three quarters of an hour in a solution of pure potash, and the liquor is then to be evaporated. Nitrate of potash will be produced, if the poison has been nitric acid.*

Treatment. The indications, according to Tartra, are two. 1. To moderate the progress of the poison, that is, to prevent the action of the uncombined portion. 2. To remedy its effects, or the changes produced by the portion that has already acted.

The first requires the instant administration of antacids, aided by neutralizing substances, as solutions of soap, magnesia diffused through water, &c. The second is to be fulfilled by means of demulcents, emollients, and antiphlogistic remedies. Barley-water, whey, milk diet, and emollient injections, are chiefly required, and all irritating and stimulating substances are to be carefully avoided.†

* Orfila, vol. 1, p. 351, 352.

† Stalpart mentions the case of a child three years old, who had taken some nitric acid, which he cured by oil and syrup of violets, and forbidding every article of food except lukewarm milk. (Vol. 1, p. 196.) He quotes instances treated in a similar manner.

It is not necessary for me to go into any detail concerning the remaining acids that have been enumerated as poisons. Their effects are generally similar to those already noticed, except that the characteristic colour of the nitric will be wanting. The mode of treatment must be similar. Orfila mentions the following as poisons: the *muriatic*, the *phosphoric*, the *fluid nitrous*, the *fluoric*, the *sulphurous*, and the *phosphorous*.

CAUSTIC OR CARBONATED ALKALIES.

Pure potash, when externally applied, is well known to act as a powerful caustic. On injecting a solution of it into the jugular, it produces sudden death; and on dissection, the blood is found coagulated. When swallowed by an animal, it corrodes the stomach, and inflames its mucous membrane.

The *sub-carbonate of potash*, (salt of tartar) is also a poison of considerable activity. A dog to whom two drachms were administered, died in fifteen minutes, and Plenck mentions a case, where a patient in good health took an ounce, which produced violent vomiting and gastritis. Life was, however, preserved.* The following are recent instances of its effects, and deserve considerable attention.

Two females, of the age of sixteen and twelve, each took by mistake half an ounce of sub-carbonate of potash. Violent sickness immediately ensued, but the error was not discovered until two hours and a half afterwards. The vomiting and sickness scarcely ever ceased entirely with the elder, and she also experienced pain in the epigastric region. Leeches were applied, and various curative means, but with little success. The vomiting, though occasionally checked, yet returned with violence, and she died in about two months after taking it. The other suffered under sickness for three days, and it then ceased.

* Orfila, vol. 1, p. 380

She appeared to grow better, but in a few weeks the sickness returned, and she was confined to her bed. Death ensued about three weeks after that of her sister.

Appearances on dissection. The appearances of disease were similar in both, although most striking in the eldest. The stomach was much thickened, and the villous coat was almost wholly destroyed; what remained, was in a state of high inflammation. The pylorus in one, was much ulcerated, and in the other, contracted and gangrenous. The intestines were gangrenous, and adhered together by thin threads of coagulable lymph. The omentum in the youngest was almost totally destroyed, and the glands of the mesentery for the most part absorbed. The liver in both was of a dark green hue, in consequence of the transfusion of bile, and the gall-bladder was distended with it, probably from the circumstance that the biliary ducts were found almost obliterated.

Both these females had previously been in delicate health.*

The peculiar styptic and urinous taste—a severe heat in the throat—retchings—vomitings of an alkaline matter, which commonly effervesces with acids—copious alvine evacuations, accompanied with violent pain, and injury of the intellectual faculties, are among the leading symptoms produced by this substance.

Orfila suggests that this alkali, of all the corrosive poisons, is that which most frequently perforates the stomach. It also causes inflammation of the different coats of this viscus, and of the intestines.

The chemical tests of potash need hardly to be repeated in this place. They can seldom be successfully applied for its detection.

We may however remark, that syrup, tea, albumen, gelatine, milk and bile are not affected by it, while red wine passes to a green on the addition of

* London Med. Repository, vol. 7, p. 118.

a few drops of the solution. Fluid blood is not coagulated by it, nor indeed by any of the alkalies. They on the contrary, prevent its spontaneous coagulation.

Antidote. Vinegar and lemon juice are the most valuable remedies for this purpose, and their use should be aided by mucilaginous drinks.

The action of *soda* is precisely similar to that of potash, as is also the mode of treatment necessary to counteract its effects.

Ammonia in its liquid state is extremely caustic and pungent. When injected into the veins, it produces a stiffness, resembling tetanus, and violent convulsions. These were soon followed by death. When introduced into the stomach, fatal effects also ensued, and the mucous membrane of the stomach was found of a red colour throughout a part of its extent, but no ulceration or perforation was present.

Cases are mentioned where the fluid ammonia caused death in the human subject, within the space of a few minutes.* And in a late work, Orfila adds a caution against its too free use, with persons who have fainted. If inspired too long, the vapour inflames the throat and lungs, and destroys the individual.† The phial containing it should only be passed from time to time under the nose.

Vinegar is here also the proper antidote, although from the rapid action of the alkali, means are generally required in addition to this, to counteract the inflammation that frequently occurs.

* Orfila, vol 1. p. 387.

† Orfila's Directions, p. 44. A case confirming this statement is mentioned in a late Journal. "A patient was recovering from a severe attack of fever; during convalescence he was without any evident cause, seized with convulsions apparently of the epileptic kind, which became more and more frequent, and ultimately were so severe as to cause great apprehension of a fatal result. In order to rouse him from the stupor succeeding one of these fits, an attendant most imprudently held aqua ammoniæ to his nose, with such unwearied but destructive benevolence, that suffocation had almost resulted. As it was, dyspnœa with severe pain in the throat, immediately succeeded, and death took place forty-eight hours afterwards. In the actual condition of the patient, there was little else than death to be expected, yet there is equally little room to doubt that the fatal event was hastened by this unhappy ministration." Edinburgh Med. and Surg. Journal, vol. 14, p. 642.

BARYTES AND ITS SALTS.

These are all poisonous.* The muriate however acts more violently than either the pure or the carbonated barytes.

Barytes whether pure or carbonated, when introduced into the stomach, produces vomiting, hiccup, insensibility, convulsions and death. The stomach was found inflamed throughout its whole extent, and extravasations of black blood were seen near the pylorus. The lungs and intestines were natural.†

Mr. Parkes mentions that he visited the mine of carbonate of barytes at Anglezark, in the county of Lancaster, and was informed by Mr. Derbyshire, who occupies the estate on which the mine is situated, that some years since, he lost three cows at one time, which had strayed from their pasture and were found licking some lumps of the spar, which at that time lay about the mouth of the mine in abundance. It was also stated, that it was impossible to keep any fowls upon the farm, as they mistook the barytes for white sand. They were sure to die on the first day, that they got out upon the land. Mr. Parkes also adds the following quotation from Leigh's History of Lancashire: "Some have been hardy enough to take a drachm at one dose, particularly one James Barnes' wife and child, and in about nine hours afterwards they expired. The like quantity in about three hours, will kill a dog."‡

Muriate of barytes, when injected into the jugular vein, caused great agitation and convulsions, and death ensued in six minutes after the operation. On dissection, the heart was found distended with coagulated blood—the stomach was natural, while the lungs were crepitating, and rather denser than usual.

When applied to a wound in the state of powder, Mr. Brodie found that it produced vertigo, paralysis

* Except the sulphate, says Dr. Ure. Dictionary of Chemistry, article *Barium*.

† Orfila, vol. 1, p. 396.

‡ Parkes' Chemical Essays, London, 1815, vol. 2, p. 217.

of the posterior extremities, general insensibility, dilated pupils, convulsions and death. The stomach and intestines were not affected. The lungs were exactly in the same situation as in the previous experiment.

Orfila and Brodie have each introduced this substance into the stomach of animals. It excited vomiting and purging, violent convulsions, and greatly accelerated the pulse. Insensibility generally ensued previous to death. The mucous membrane of the stomach was of a livid red colour, and it could be easily rubbed off. The muscular coat exhibited two broad patches of a cherry red colour. The lungs were natural, but the left ventricle of the heart contained black fluid blood.*

We have also some instances of its effects on the human system. An over-dose (probably seventy or eighty drops) excited violent purging and vomiting, loss of muscular motion in the limbs, and coldness of the extremities, from which the patient did not recover in some days.† An ounce in solution, which was taken by mistake for Glauber's salts, produced instant vomiting, convulsions, pain in the head and deafness, and death supervened within an hour after the exhibition of the poison.‡

Chemical Proofs.

Carbonate of barytes is insoluble in water, and effervesces when dissolving in the nitric and muriatic acids.

Muriate of barytes is soluble in water, and is decomposed by the carbonates of potash and soda. Carbonate of barytes is precipitated.

Nitrate of silver causes a precipitate of muriate of

* Chaptal mentions, that MM. Huzard and Biron gave to some horses the muriate and carbonate of barytes in doses of 118 grains every day, and these animals died suddenly after having taken them for a few days.—Chemistry applied to the Arts, vol. 2, p. 74.

† Med. Commentaries, vol. 19, p. 151.

‡ Brande's Journal, vol. 4, p. 382.

silver. The hydro-sulphurets do not affect its solution.

Wine is very slightly affected by the solution of the muriate. Syrup, tea, albumen, gelatine, and milk are not altered; but human bile is precipitated of a greenish yellow.

Pure barytes acts in a similar manner on the above animal and vegetable substances.*

The chemical characters above stated, sufficiently distinguish the salts in question, but if they be mixed with fluids which prevent the full action of the tests, the suspected substances must be treated with the sub-carbonate of ammonia dissolved in water. A precipitate of carbonate of barytes is thus obtained, which, after being dried, should be calcined with charcoal. Caustic barytes will thus be obtained.

The same direction also applies to cases, were muriate of barytes is the supposed poison.

Antidotes. From the experiments of Orfila, it appears that the sulphate of soda or magnesia, is the proper remedy, when early administered. These decompose the poison and produce an insoluble sulphate of barytes. Vomiting must always be encouraged.

Quicklime was introduced into the stomach of a small dog to the extent of a drachm and a half in powder. It caused vomiting and the discharge of much saliva, with some pain. He however recovered on the next day. Three days thereafter, three drachms were administered. Vomiting and dejection ensued, and he died in three days, without having experienced either vertigo, convulsive motions or paralysis.

The mouth, fauces and œsophagus were slightly inflamed, and the mucous membrane of the stomach was inflamed throughout its whole extent. The intestines and lungs were natural.

Quicklime is thus evidently not a very powerful poison.

Its chemical characters are well known, but if any

* Orfila, vol. 1, p. 390, 392.

doubt exist, it must be calcined, in order to be reduced to a caustic state.

Wine changes lime-water to a yellow colour and gives a brown precipitate. Tea in small quantity, gives a greenish precipitate, but when a large quantity of lime-water is added, the deposition is of a red ochre colour. Albumen, gelatine and milk produce no change, but human bile deposits after a few hours, a brown precipitate.

The same mode of treatment that was mentioned respecting persons poisoned by caustic potash and soda, is advisable in this instance.*

HYDROGENATED SULPHURET OF POTASH. *(Liver of sulphur.)* This substance, which formerly was deemed an antidote of arsenic and corrosive sublimate, has been ascertained to be one of the most powerful of the corrosive poisons. A French countess swallowed by mistake some of it which was intended for the preparation of a bath, and she expired in a few minutes.†

When introduced into the stomach of animals, whose œsophagus had been tied, it produced violent attempts to vomit, hurried respiration, panting, tetanic convulsions, and death. The stomach was found much inflamed, and covered over with yellowish white spots; the duodenum and jejunum were inflamed; the lungs were partially gorged, and the left ventricle contained black blood. Vomiting was excited when the œsophagus was not tied.

* Orfila, vol. 1, p. 401.

† Orfila's directions, p. 68. Probably this is the same case which is quoted from Dr. Montgarny's *Essai de Toxicologie*, in the London Med. Rep. vol. 10, p 511. "A lady suffering from pyrosis, died in a few minutes, after having swallowed a few mouthfuls of an aqueous solution of the sulphuret of potash. The fatal event was preceded by faintness, convulsions, and the issue of a yellowish froth from the mouth. On dissection, the stomach was found very much contracted, its internal membrane lined with sulphur and of a brightish red colour, and its capillary system, in some points, minutely injected The duodenum was red and inflamed, particularly towards its duodenal extremity. The superior portion of the small intestine in about a fourth of its extent, presented the same appearances. The membrane of the mouth, pharynx and bronchiæ was whitish and coloured, but displayed no change of structure. The lungs were soft, not crepitous, and gorged with black, livid and very fluid blood."

When injected in solution into the jugular, it produced immediate tetanus, from which, in one instance, the animal quickly recovered, and in another, he perished. The blood in the heart was fluid, and in the left ventricle, of a deep red.

The deduction drawn by Orfila from his experiments with this substance is, that the corrosion excited by it is slighter in proportion as the dose is stronger, and the nervous phenomena will then be much more severe.*

Liver of sulphur is decomposed by the acids, and sulphuretted hydrogen is given out. Corrosive sublimate, acetate of lead, nitrate of bismuth, and the salts of copper, all yield a black precipitate on the addition of a few drops of this substance. Tartar emetic, an orange-yellow one, and arsenious acid, applied to a small quantity, a white precipitate; to a large quantity, a yellow one.

Treatment. Vinegar or lemon juice, mixed with water, should be administered. This excites vomiting, and may decompose the poison. We should then guard against inflammation.†

NITRATE OF POTASH. *(Nitre, Salt-petre.)*

This salt, in large doses, acts as a corrosive poison, and cases illustrative of this effect are mentioned by various writers. An individual, labouring under fever, took by mistake an ounce and a half of nitrate of potash. In a short time, severe anguish, with a sense of internal cold, supervened, and fainting and syncope followed. He died in less than ten hours.‡

A female took an ounce and a half by mistake. It excited vomiting and purging, with violent pain in the bowels. The extremities were cold, while a burning

* He adds, that Magendie has observed, that when a drop of a strong solution of liver of sulphur is put into the mouth of a very young dog, the animal dies in a short time, and after death the trachea is filled with mucus

† Orfila, vol. 1, p. 508. Orfila's Directions, p. 68.

‡ Quoted from Comparetti. Orfila, vol. 2, p. 87.

sensation was experienced in the stomach ; the pulse was almost imperceptible, and she died in sixty hours after taking the salt. On dissection, the stomach was found red, and scattered over with blackish spots, and in the centre was a small hole, which perforated it. The intestinal canal was reddish.*

In a third case, related by M. Laflize, an ounce produced similar effects, and death in three hours. The stomach was very highly inflamed, and its mucous coat detached in several places ; the external coat was of a deep red, and some brown spots were observed on it.†

There are, however, some instances where patients have recovered, after taking large doses. A pregnant female by mistake took two ounces, which immediately excited vomiting, first of the contents of the stomach, and then of blood. As soon as the alarm was taken, warm water and mucilaginous drinks, (gum arabic, linseed tea, &c.) were exhibited. Burning pains at the stomach, however, supervened, the pulse sunk, and a cold clammy sweat broke out. The vomiting recurred frequently with violence. From this she was gradually relieved, but the pains in the abdomen continued for a longer time, and when convalescent, and ten days after the taking of the salt, she was seized with a nervous affection, greatly resembling chorea. Twitchings of the muscles and involuntary motions, were present to an alarming degree, and they continued for two months. They gradually left her, and she was at last happily delivered.‡

* Case by Souville. Orfila, vol. 2, p. 87.

† See Foderè, vol. 4, p. 82. Metzger, p. 385 ; and Belloc, p. 141, refer to several cases where nitre has proved poisonous.

‡ Case by Mr. Butter, in Edin. Med. and Surg. Journal, vol. 14, p. 34. This gentleman observes, that he is not aware of any case on record where a patient has taken and recovered from so large a dose of nitre. There is, however, another in the memoirs of the Medical Society of London, related by Dr. Falconer, vol. 3, p. 527. The individual, (a blacksmith) took two ounces, and his symptoms were similar to those already detailed, except that he vomited blood to the amount of a quart. He was ill for many months afterwards, and was not dismissed cured from the hospital until nearly a year after the accident. Other cases of recovery are cited by Orfila.

Effect on animals. Five drachms and a half given to a dog caused vomiting, but on the day following he ate well and experienced no remarkable symptoms. But when the œsophagus was tied, and the salt introduced into the stomach, it excited vertigo, pain, slight convulsions, insensibility, weakness and death. The mucous membrane of the stomach was inflamed, and scattered over with black spots. The lungs were natural.

When nitre in powder was applied to a wound on the back of a dog, it produced no effect. But an application of it to an incision near the femoro-tibial articulation, produced gangrene, after some days, and the animal died.*

The distinguishing properties of nitre, are its crackling when thrown on burning coals, and the disengagement of white vapours when sulphuric acid is added.

The treatment employed in the case already related is probably the most advisable. Vomiting should be excited, while the stomach is protected by mucilaginous drinks.

Muriate of ammonia, *(Sal Ammoniac,)* is poisonous when taken into the stomach, or applied in large quantities to wounds. It causes vomiting, convulsions, pain in the bowels, and death. Dr. Smith applied it to the cellular texture of the thigh of dogs, vomiting ensued, with great weakness, which increased until death. The mucous membrane of the stomach presented several gangrenous ulcerations and was generally inflamed; the whole digestive canal contained a blackish fluid and the rectum was inflamed. In another instance, the mucous membrane was found in a state of putridity.†

Treatment. Vomiting should be excited by warm water or irritating the throat, and the nervous or inflammatory symptoms are then to be counteracted by the means already noticed.

* Orfila, vol. 2, p. 84. † Ibid. vol. 2, p. 469.

GASES.

Several of these have been made the subject of experiment on animals, while in some instances, they have unfortunately proved destructive to human life.

Chlorine in a gaseous state destroys those who breathe it, by producing great irritation of the bronchiæ, and even when diluted with atmospheric air, it causes cough and inflammation. Pelletier is thus said to have fallen a victim to its effects.

In the summer of 1821, Dr. Francis was called to a child aged seven years, who had through accident inhaled a portion of this gas from a bottle. The action of this substance was most sudden—immediate congestion of the bronchiæ and lungs, a laboured cough, and appearance of unavoidable suffocation. The patient was forthwith removed into the open air, and blood taken from the arm. These means were followed by the mechanical elevation and depression of the ribs, as in giving action to the chest in cases of asphyxia. Considerable irritation of the lungs continued for several days after the child's recovery.*

Nysten and Orfila have performed several experiments with gaseous chlorine on animals. When injected into the jugular, it caused pain, difficult breathing and speedy death; and the blood, on examination was dark coloured and altogether fluid. The injection of it into the pleura, excited great agitation, extreme pain, and trembling of the limbs, but the animal survived the immediate effects. On the third day he was killed, and the pleura was found covered with a false membrane, and bore all the appearances of recent inflammation.†

Fluid Chlorine when introduced into the stomach, caused dejection and death; and on dissection, the mucous membrane of the stomach was either extensively inflamed or ulcerated. The other organs were unaffected. It is hence evident that its action resembles that of the other acids.

* MS. Communication.
† Orfila, vol. 2. p. 92.

Nitrous acid gas, or more correctly, *nitric acid gas*. Dr. Desgranges has presented a valuable case illustrative of the effects of this substance on the animal œconomy.

A merchant at Lyons, aged 45, and of a tolerably strong constitution, had stored a considerable quantity of nitrous acid in his warehouse. He was awoke one morning, by the howling of the watch dog, which he had shut up in it, and on opening the door, immediately perceived the smell of nitrous gas. The dog rushed out with his paws burnt, ran to the nearest water to quench his thirst, and after playing an hour or two with some other dogs, he returned and expired at his master's door, after vomiting thick stuff of various colours.

The merchant attempted to enter the warehouse, but was driven back in a few minutes, by the approach of suffocation. He however persisted in again visiting the room, and finally succeeded in carrying out the broken cantines. Two were found empty, each of which had contained thirty-two pounds of aqua fortis.

This was early in the morning. At six o'clock he breakfasted, and then went to pay a visit, but returned before eight, with a dry and burning heat in the throat, irritation in his stomach and breast, and a very painful sense of tightness near the attachment of the diaphragm. He was advised to drink freely of milk, and fomentations were applied to the abdomen, together with sinapisms to the arms. The two last remedies seemed to fatigue him much, and to augment his distress, but he continued the milk. At one o'clock he felt easier, had a spontaneous yellow stool, and in the space of an hour two others, both of the colour of citron ointment. His urine was scanty, and in the evening he experienced frequent pressing desire to make water, but always in vain. At four o'clock he began to expectorate a yellowish matter, and had afterwards a little cough and slight vomiting. Injections were given him, which came off instantly, but

coloured yellow. At nine, his body became of a blue colour, his breathing was oppressed, there was some rattling in the throat and hiccup, and he complained of great pain in the abdomen and acros the bottom of the thorax. Convulsive motions, and slight delirium also supervened. Towards morning his anguish increased, and his anxiety became inexpressible. He however preserved his senses until six, and died at seven o'clock. Shortly after death, his belly swelled and became distended in a very remarkable manner, his face was purple, his lips black, and some blood issued from his nose and mouth. The body was not opened.*

There is also a curious case related in the Philosophical Transactions by Dr. Mounsey, where a long train of symptoms afflicted an individual at Moscow, apparently from inhaling the fumes of a mixture of verdigris and false gold leaf with nitric acid. Red spots appeared on various parts of his body—nausea, pain, and anxiety at the pit of the stomach came on, and it was not until after several days, that he was relieved from the pains in various parts of his body.†

Sulphurous acid gas. This is constantly disengaged when sulphur is burnt in the open air. It is also produced by the roasting of various metals.

In March, 1817, a number of miners at the Leadhills in Scotland, who had gone down to work at the depth of twenty-five fathoms, were suddenly seized with difficulty of breathing, violent pain in the head, weakness of the lower extremities, palpitation, and in some cases vomiting. Giddiness ensued, and in a short time complete mania. Some were furious, and others listless, or appeared as if they were intoxicated. Vomiting or retching generally came on, when they had been exposed for some time to the air above ground; and in other cases, tenesmus was present. By the use of emetics or purgatives, as the symptoms indicated, they were relieved, and recover-

* Edinburgh Med. and Surg. Journal, vol. 3, p. 16.
† Phil. Trans. vol. 50, p. 19; and vol. 54, p. 15.

ed in the course of a few days. Two, however, who could not be brought up, were deprived of life.

The accident in this instance, was attributed to a quantity of smoke escaping from the chimney of the engine under ground, into the way-gates, and so contaminating the air in the workings, from the sulphurous acid gas which it contained, as to render it deleterious. It evidently was but slightly charged with carbonic acid gas, since the candles burnt, though faintly, at the place where the men perished.*

In the following instance, I also apprehend that sulphurous acid gas was the main cause of death.

In November, 1821, a smith at Maidstone, was repairing the inside of the boiler of a steam engine, and in joining two pieces of iron, he made use of a cement composed of sal-ammoniac, sulphur and iron turnings, which produced such a quantity of fumes, that he was suffocated in a few moments. His assistant being at work on the outside, and hearing a struggling noise within, got through the opening at the top of the boiler, and while descending to his master's assistance, inhaled the fumes and fell to the bottom. A workman attempted twice to descend to his assistance, but he was so powerfully affected by the effluvia, that he was obliged to desist. A large quantity of water having been thrown into the boiler, the bodies were brought out. The master was quite dead, and his assistant, though he exhibited some signs of life when taken out, died next morning.†

Nitrogen, is classified by Orfila among the narcotic poisons. Animals when plunged into it, experience a difficulty of respiration, which gradually becomes more rapid and weaker, but without any lesion of the nervous functions. Life is however readily restored by exposure to the atmosphere.

* Edinburgh Med. and Surg. Journal, vol. 13, p. 353; case by Mr. Braid, surgeon. Water, on being thrown down the shaft, improved the air so much, probably by absorbing the sulphurous acid gas, that one person, who had lain insensible for an hour at the side of the shaft, was restored.

† Edinburgh Philosophical Journal, vol. 6, p. 402, from the Technical Repository.

Dupuytren has ascertained that this gas is one of the causes of the asphyxia arising from privies.*

Carbonic oxide. This forms a part, as we have already stated, of the deleterious gases arising from the burning of charcoal. There are however one or two facts on record of its influence when prepared in the laboratory.

Sir Humphrey Davy inspired it, in a state of mixture, with about $\frac{1}{4}$ of common air. The effect was a temporary loss of sensation, which was succeeded by giddiness, sickness, acute pains in different parts of the body, and extreme debility. Some days elapsed before he entirely recovered.†

Mr. Witter, of Dublin, desirous of fully ascertaining the effects of carbonic oxide, when freely inhaled, took three or four full inspirations of it. The consequence was an inconceivably sudden deprivation of sense and volition. He fell supine and motionless on the floor, and continued in a state of total insensibility for almost half an hour, and apparently lifeless, as pulsation was nearly extinct. Various restorative means were used without success, but on the introduction of oxygen gas into the lungs, he recovered with convulsive agitation, excessive head-ache, and quick irregular pulsation; and for some time after mental recovery, total blindness, extreme sickness, and vertigo, were experienced. An unconquerable propensity to sleep succeeded, after which he gradually recovered.‡

The following curious fact has also been considered as illustrative of the effects of the carbonic oxide. I quote it for its singularity, although I am not satisfied but that other causes may have aided in producing the disease.

"The workmen of a cotton manufactory at Argues, near Dieppe, were attacked with nausea, vertigo and convulsions, which so much affected their imagina-

* Orfila, vol. 2, p. 168.
† Davy's Elements of Chem. Philosophy, p. 172. Amer. ed.
‡ Eclectic Repertory, vol. 5, p. 540.

tions, that they thought they saw spectres and other fantastic objects flying at them, and seizing them by the throat. Mr. Nicolle, an apothecary at Dieppe, published a memoir on this disease, and he attributes it to the gaseous oxide of carbon, resulting from the decomposition of the oil, by the heat of a cast iron stove, on which they were in the habit of placing their vessels of that fluid. This gaseous product being lighter than the atmosphere, would ascend, and in this way, he accounts for the fact, that the persons in the upper stories of the manufactory, were first affected, while those on the ground floor were generally preserved from it."*

Another substance remains to be noticed, and principally for the purpose of establishing its *innoxious* properties. I refer to

GLASS AND ENAMEL IN POWDER.

This was formerly deemed a highly poisonous substance. It was one of the articles administered to Sir Thomas Overbury for his destruction, and toxicologists and medical jurists even to the present day, continue its arrangement with the corrosive poisons. Various experimenters have however, given it in considerable quantity to animals, and even to men, without producing any injury. Le Sauvage administered several drachms to cats, dogs and rats, and neither during life was any illness perceived, nor on being killed for the purpose of dissection, was any lesion noticed in the stomach or intestines. Caldani and Mandruzatto, are also said to have made similar experiments on animals, and the latter on himself, with the same results.† It would thus seem, that the substance in question can hardly be deemed a poison, at least in the ordinary sense of the term.

* Silliman's Journal, vol. 6, p. 199.

† Orfila, vol. 1, p. 418. Marc, p. 61. Le Sauvage, also made numerous experiments on himself, with pounded glass, but *no inconvenience or injury was produced.* See the New-York Med. Repository, vol. 14, p. 406, for a statement of his experiments.

But there is no doubt, that it may produce injury by its insolubility, and its mechanical properties. If the fragments be coarse or large, inflammation may arise from the irritation that is excited.*

There is a remarkable case on record, where a husband was accused of having poisoned his wife by means of this substance, and as the question in controversy was referred to two eminent physicians, I conceive I shall do a service, in giving the leading particulars, and their decision.

Louis Lavalley, a young man residing near Bayeux, in France, became attached to Maria Guerin, the daughter of a neighbour. After the intimacy had continued for some time, it was discovered that she was pregnant, and her relatives urged the necessity of marriage. As Louis continued deeply enamoured of the female, but little difficulty was experienced in effecting this, and his parents readily consented to the union. They were married on the fifth of November, 1807, but were to remain separate at the request of the family of Guerin, until after her delivery.

On the thirteenth of December, Lavalley invited his wife and father-in-law to a family dinner. The entertainment consisted of roast pig, black pudding, and calf's liver; and the bride partook freely of all of them. To these, coffee succeeded, and she mixed a little brandy with her's. She was urged to remain that evening, but her father opposed it, and she returned to his home with him. She continued well during the night, but early on the next morning, was seized with violent pains, and in four or five hours, convulsions followed. Medical aid was afforded, but without relief. Delivery with instruments

* Foderè, vol. 4, p. 115; and Marc, p. 61, appear to consider it a poison. Metzger observes, "La similitude d'action du verre en fragmens grossiers, et de tous les corps siliceux, m'engage encore à les placer dans cette classe," (des poisons caustiques,) p. 121. A remark of Foderè, though not in the way he intends it, may be applied to this substance. If glass in fragments be poisonous, a fish-bone irritating the stomach or intestines, may, with the same propriety, be called poisonous.

was then attempted, but an alarming hæmorrhage obliged the accoucher to abandon it, and finally, as death seemed inevitable, the infant was extracted by the cæsarean operation. She died during this, and her infant did not survive her. The funeral took place as usual; but about a month after her decease, and after some disagreement had taken place among the families, concerning the disposition of her marriage settlement, a report came into circulation that she had been poisoned, and her husband was named as the murderer. The body was disinterred, forty-two days after death, and although putrefaction was greatly advanced, yet the stomach and other viscera were removed and carried away for examination.

The reports made concerning the dissection, were as follows: The stomach, duodenum, ileon and rectum on being opened, exhibited numerous black points and spots. On the internal coat of the intestines a whitish substance was discovered, which was ascertained by the magnifying glass and chemical experiments, to be *pounded glass.* Vesicles resembling the effects of a burn, were also present, and particularly in those places where the black spots were most numerous; and some slight erosions were observed. On these grounds, the surgeons and chemists gave it as their opinion, that the pounded glass had produced the symptoms, and the fatal termination.

Lavalley was dragged to prison, with every mark of opprobrium. His advocate, however, addressed several questions to the president of the school of medicine, for the purpose of elucidating the medical testimony. And these were answered by two of the professors, whose names are well known throughout the medical world—Baudelocque and Chaussier. Their report is dated March, 1808. After stating the questions put to them, I shall detail the substance of their answers.

The first interrogatory was, whether from the facts stated above, there appeared to be any natural causes for the death of the female, either as regards her sit-

uation, the food she had taken, the medical assistance she had received, or the omission of proper remedies?

To this, it is replied, that the nature of the food taken by the female being rather indigestible, the addition of brandy to her coffee, and her subsequent walk, all might have aided in producing indigestion —that this is a common occurrence from any impropriety in eating, with females advanced in pregnancy, and that convulsions is in these cases, a common consequence of indigestion. As to the treatment, they decline any observations, but intimate an opinion, that the attempted delivery with instruments when no dilatation was present, as well as the cæsarean operation, were both improper.

The second question was, whether her death ought to be attributed to the pounded glass found in the stomach and intestines—whether this glass is a poison, and if so, what are its effects, and mode of operation, and do these correspond to the appearances observed on dissection?

The professors intimate a doubt, whether the substance found was actually glass, but admitting it was so, they proceed to examine its nature. They observe that it is a common and ancient opinion, that rock crystal, the diamond, glass, and other analogous substances, are active and dangerous poisons, since by their hardness, they tear and pierce the coats of the intestines. This belief, however, is shown to be totally incorrect by numerous quotations from various authors, of persons who had swallowed diamonds, and of eaters of glass, in large pieces—all of whom had escaped injury. They declare, that glass in a state of fine powder, is an inert substance, and particularly so when the stomach is filled with food. The idea of its being taken in the coffee, is at once refuted by the fact, that it would fall to the bottom by its own gravity; and it is suggested, whether if glass were actually present in the intestines, it might not have come from some vessel which she had broken with her teeth during the existence of the convulsions.

The last question was, whether putrefaction would not produce great changes in a body, forty-two days after death ; and if so, what caused the state of the viscera as reported by the examiners ?

It is replied, that usually the term of forty days produces such a change as to render an examination altogether uncertain, but even allowing the season to have been favourable for the preservation of the body, they do not conceive the facts stated to indicate the results of poison. Convulsions supervening on a full stomach, and passing to a fatal termination, would leave an engorged state of the vessels in various parts, and predispose to ecchymosis, while the progress of putrefaction would readily explain the black spots that were observed. The medicines administered, being antimonial emetics, and an enema of senna, must also, and particularly as they proved inefficacious, have aided in determining the irritation to the stomach and bowels. As to the erosions, they remark, that their appearance proves little, since they are frequently observed in those who die from diseases which exclude all idea of poison.

The professors conclude with observing, that as natural causes will abundantly account for the death of the female, they consider the accused husband as guiltless ; and when brought to trial before the criminal court of Caen, he was acquitted by the *unanimous* verdict of the jury.*

I shall conclude this chapter with a statement of some general results drawn from experiments on the principal poisonous minerals. These, I should presume, would often prove of great assistance in guiding the examinations of the medical jurist.

We shall first suppose that the poison discovered is solid ; and the earliest subject of enquiry in that case, is its solubility. We may attempt this in cold water, but generally it will be most satisfactory in boiling water, and the process should be continued

* Causes Celèbres, par Mejan, vol. 2, p. 324 to 366 ; vol. 3, p. 344.

for at least a quarter of an hour. In both instances, distilled water should alone be used. The following table indicates the substances which will, or will not be dissolved:

Substances soluble in water, wholly or in part.	*Substances insoluble.*
Corrosive sublimate.	Red precipitate of mercury.
Arsenious acid.	Black oxide of mercury.
Muriate of antimony.	Turbith mineral.
Sulphate, muriate, and nitrate of copper.	Red and yellow sulphurets of arsenic.
Muriate of tin.	Peroxide of antimony.
Sulphate of zinc.	Golden sulphur.
Nitrate of silver.	Kermes.
Muriate of gold.	Peroxide of tin.
Nitrate of bismuth.	Oxide of zinc.
Potash: sub-carbonate of potash.	Sub-nitrate of bismuth.
Soda: sub-carbonate of soda.	Carbonate of barytes.
Sub-carbonate of ammonia.	Carbonate of lead.
Barytes: muriate and nitrate of barytes.	Cinnabar.
Lime.	
Nitrate of lead.	
Nitrate of potash.	
Sulphate of iron.	
Muriate of ammonia	
Sulphuret of potash.	

Having determined the fluid to be SOLUBLE, it is filtered, and a small quantity is put in a test glass. To this, a few drops of a hydro-sulphuret are added, and the effects will be as follows:

Substances precipitated by the hydro-sulphurets.	*Substances which are not precipitated by the hydro-sulphurets.*
Corrosive sublimate—black.	Arsenious acid.
Muriate of antimony—orange or red.	Potash, and its sub-carbonate.
Soluble salts of copper—black.	Soda, and its sub-carbonate.
Muriate of tin—black or chocolate, or yellow.	Barytes, and its muriate and nitrate.
Sulphate of zinc—yellowish white, or deep brown.	Lime.
Nitrate of silver—blackish brown.	Nitrate of potash.
Muriate of gold—deep chocolate.	Muriate of ammonia.
Nitrate of bismuth—black.	Sulphuret of potash.
Sulphate of iron—blackish green.	
Nitrate of lead—black.	

A fresh quantity of the original fluid should now be taken, and submitted to the action of caustic alcoholized potash. And the following is the effect on those solutions which are precipitated by the hydro-sulphurets:

Solutions which yield a white precipitate with caustic potash.	*Solutions which yield with potash coloured precipitates, or are not precipitated at all at the ordinary temperature.*
Muriate of antimony.	Corrosive sublimate—canary yellow.
Muriate of tin.	Salts of copper—blue.
Sulphate of zinc.	Nitrate of silver—deep brown.
Nitrate of bismuth.	Muriate of gold—no precipitate when cold.
Nitrate of lead.	Sulphate of iron—green or red.

We have now obtained two results with the substances in the right hand column, (with the hydro-sulphurets and the caustic potash.) These are sufficient indications to guide the examiner in his investigations, and he must refer to the head of chemical proofs, as given under each individual poison, for additional verification.

Of those substances which give a white precipitate with caustic potash, one, the nitrate of lead, is precipitated by the muriatic acid; the others are not affected by it. We have then four remaining. Two of these give a white precipitate, or become milky with distilled water, viz. muriate of antimony and nitrate of bismuth; while the remaining two, being muriate of tin and sulphate of zinc, undergo no alteration from it. Each of these must then be examined by additional tests, as directed in former pages.

We return to the substances that have not furnished any precipitates with the hydro-sulphurets; and they are divisible as follows:

Substances which turn the syrup of violets green.	*Substances which do not.*
Potash: sub-carbonate of potash.	Arsenious acid.
Soda: sub-carbonate of soda.	Muriate and nitrate of barytes.
Sub-carbonate of ammonia.	Nitrate of potash.
Barytes.	Muriate of ammonia.
Lime.	

Among those which have turned the syrup of violets green, the sub-carbonate of ammonia may be readily distinguished by its smell, and of the remainder, barytes and lime are precipitated by the sub-carbonate of potash, while the others are not precipitated by it. Barytes may then be distinguished from lime,

by the addition of sulphuric acid. This re-agent precipitates the former, and not the latter. Potash and soda are to be distinguished by the nitro-muriate of platina.

Of those which have not turned the syrup of violets green, one precipitates hydro-sulphuretted water and lime-water of a yellow and white colour, viz. the arsenious acid. The others are not affected. Then add sub-carbonate of ammonia to them. It

precipitates	*and does not precipitate*
The soluble salts of barytes;	Nitrate of potash, And muriate of ammonia.

If we add lime to the muriate of ammonia, the disengagement of ammonia will indicate its nature.

We come next to that class of substances which were INSOLUBLE in distilled water. The colour should first be noticed.

Poisonous substances insoluble, of a white colour.	*Insoluble poisonous substances, coloured.*
Peroxide of antimony.	Red precipitate of mercury.
Peroxide of tin.	Black oxide of mercury.
Oxide of zinc.	Turbith mineral, yellow.
Sub-nitrate of bismuth.	Sulphurets of arsenic, yellow or red
Carbonate of barytes.	Kermes, brown-red.
Carbonate of lead.	Golden sulphur of antimony.
	Cinnabar.

Treat the white substances with nitric acid—

It dissolves	*It does not dissolve*
Oxide of zinc, } without ef-	Peroxide of antimony.
Sub-nitrate of bismuth } fervescence	Peroxide of tin.
Carbonate of barytes. } with effer-	
Carbonate of lead, } vescence.	

On the solution that has dissolved without effervescence, pour some distilled water. If it be bismuth, there will be a white precipitate, while the nitrate of zinc will be unaffected. To the solution that has dissolved with effervescence, add pure ammonia. The lead will furnish a white precipitate, while the barytes remains transparent. Lastly, the antimony and tin must be treated with muriatic acid, and the

muriate of tin thus procured will not be disturbed by distilled water, but the muriate of antimony will yield to it an abundant white precipitate.

Four of the coloured substances are red—red oxide of mercury, cinnabar, red sulphuret of arsenic, and kermes mineral. The red oxide and the kermes dissolve in muriatic acid; the others do not. Their nature, and those of the remaining substances, may then be investigated by the directions already laid down.

When the poison is in a fluid state, the same course should be pursued as directed concerning soluble solid substances.*

As to the punishment of murder by poisoning, it is not necessary for me to enlarge. It is sufficient to state, that in all civilized countries, it is deemed the most atrocious of crimes, and is marked by the severest punishment.† With respect to time, it is deemed murder in England, if the party poisoned die within a year; and in the state of New-York, it is enacted, that the punishment for poisoning, where the individual poisoned does not die within a year and a day, shall be imprisonment in the state prison for a term not exceeding fourteen years. ‡ I cannot find a provision on this point in the laws of other states.

*The above directions are taken from Orfila, vol. 2, p. 502 to 512. Marc. (p. 74 to 78,) has drawn up a sketch somewhat similar, but not by any means so complete, as the one here presented.

† Ehrmann in Schlegel. vol. 3, p. 163 to 185, has collected the laws of various countries on this crime.

‡ Revised laws, vol. 1, p. 409.

CHAPTER VI.

VEGETABLE POISONS.

1. Irritative or acrid poisons—Veratrum album—viride. Helleborus niger—fœtidus. Bryonia dioica. Elaterium. Colocynth. Gamboge. Daphne gnidium—mezereum—laureola. Ricinus communis. Euphorbia officinarum, and other species. Savine. Rhus radicans—toxicodendron—vernix. Anemone pulsatilla, and other species. Aconitum napellus, and other species. Œnanthe crocata—fistulosa. Ranunculus acris, and other species. Colchicum autumnale. Chelidonium majus—glaucium. Delphinium staphysagria. Narcissus pseudo-narcissus. Gratiola officinalis. Jatropha curcas—manihot. Scilla maritima. Sedum acre. Rhododendron chrysanthum—ferrugineum. Fritillaria imperialis. Pedicularis palustris. Cyclamen europœum. Plumbago europœa. Scammony. Cerbera. Cynanchum. Lobelia syphilitica—longiflora—inflata. Apocynum. Asclepias. Hydrocotile vulgaris. Clematis vitalba, and other species. Pastinaca. Sælanthus. Calla palustris. Phytolacca decandra. Croton tiglium. Various species of Arum. Equisetum hyemale. Oil of tansy. Symplocarpus fœtida. Treatment of persons who have taken these poisons. OXALIC ACID. Symptoms—appearances on dissection—effect on animals—tests—antidotes. Tartaric and citric acids. 2. Narcotic poisons. Opium—its compound nature—symptoms—effects, even in small doses, on children—appearances on dissection—effects on animals—treatment. Hyoscyamus niger—albus, and other species. PRUSSIC ACID. Symptoms—effects on animals—tests—treatment. Plants which contain prussic acid—laurel water—case of Sir Theodosius Boughton—bitter almonds—kernels of the peach. Lactuca. Solanum. Taxus baccata. Actæa spicata. Physalis somnifera. Azalea pontica. Peganum harmela. Ervum ervilia. Lathyrus cicera. Paris quadrifolia. Gelseminum nitidum. Treatment. 3. Narcotico-acrid poisons. Atropa belladonna. Datura stramonium, and other species. Nicotiana tabacum. Digitalis purpurea. Conium maculatum. Cicuta virosa—maculata. Brucea antidysenterica. Laurus camphora. Cocculus indicus. Poisonous mushrooms—their characters—symptoms—appearances on dissection. Alcohol. Sulphuric æther. Ergot. Lolium temulentum. Diseased wheat. Anagallis arvensis. Aristolochia clematitis. Æthusa cynapium. Ruta graveolens. Nerium oleander. Mercurialis perennis. Chaerophyllum sylvestre. Sium latifolium. Coriaria myrtifolia. Upas Tiente—Upas antiar. Strychnos nux vomica. Strychnos ignatia. Ticunas. Woorara. Hippomane mancinella. Curare. Calidium seguinum. Ava. Spigelia marilandica. Kalmia latifolia. Sanguinaria canadensis. Treatment

We come now to the consideration of a class of poisons, which present much greater obstacles to their discovery, than the one we have already considered. "So far as we know, there are no tests by which vegetable poisons can be detected, and their effects on the primæ viæ cannot in most cases, be distinguished from those produced by various diseases." The symptoms are hence the leading guide in our investigation.*

As the deleterious substances belonging to the vegetable kingdom are very numerous, it will greatly facilitate the investigations of the student, as well as aid the practitioner, to divide them according to their characteristic effects. And in doing this, I shall pursue the classification proposed by Orfila. Whatever may be its defects as a general system, yet as to this particular division, it is an approach to the truth, and in many respects is unquestionably the best yet offered.

I shall therefore divide vegetable poisons into three classes—the irritating, corrosive or acrid—the narcotic or stupifying—and the narcotico-acrid.

In proceeding to the consideration of individual substances, I will barely remark, that I shall study conciseness as much as possible; and while I shall notice all cases illustrating their effects on the human system, and on animals, will omit, except in remarkable instances, the symptoms and appearances produced by their introduction into the veins. A detail of these is evidently not important in the present work. There is also another consideration which will warrant a due degree of brevity: *Vegetable poisons are seldom the instruments of murder.* When death is produced through their operation, it generally originates from suicide or accident, and the coro-

* It sometimes happens, however, that portions of the vegetable poison are either rejected by vomiting, or discovered in the stomach after death. In these instances, it must always be proper to reduce it by chemical analysis to its proximate principle, and particularly if the body in question is suspected to belong to that class in which vegetable alkalies have been detected.

ner therefore is the only legal officer whose examination is required.

1. Irritative or acrid poisons.

Veratrum album. (White hellebore. Indian poke.) The root of this plant has long been distinguished for its poisonous qualities. Etmuller states, that when applied to the abdomen, it produces violent vomiting, and the same phœnomenon has been observed, by Schroeder, when it was used as a suppository. Internally, it produces spasms, suffocation, loss of voice, and coldness over the body. Vicat relates the case of a family, who took some soup in which the root of white hellebore had been put instead of pepper. Shortly after, they were seized with a general coldness, and their bodies became covered with an icy sweat. Debility and an almost imperceptible pulse succeeded, and they were not relieved until vomiting came on. The root when powdered is a powerful errhine.

When administered to dogs, it produced violent vomitings and debility, and when the œsophagus was tied, there was violent straining, dejection, vertigo, and finally death. On dissection, the mucous membrane of the stomach was seen red, but not ulcerated. The other parts were natural. On inserting the root in powder into a wound on the thigh of a dog, similar symptoms were produced, accompanied with dilatation of the pupils, and the stomach after death presented the same appearance as in the previous instance.*

Veratrum viride of Aiton and Willdenow, is a native of New-England, and is said to have produced dangerous and even mortal effects. The root is bit-

* Orfila, vol. 2, p. 3 to 6. Pelletier and Caventou have discovered in this plant a new alkaline principle, which they denominate *Veratrine*. It has also been detected in the seeds of the *veratrum sabadilla*, and the root of the *colchicum autumnale*. It is endowed with excessive bitterness; excites, even in minute doses, violent vomiting, and a few grains destroy the life of animals. Brande's Journal, vol. 10, p. 171. London Med. Repository, vol. 14, p. 427.

ter, nauseous and acrid, and burns the mouth and fauces.*

Helleborus niger. (Black hellebore.) Morgagni mentions a case, where an individual under cure in the hospital, took about half a drachm of an extract made with water from the roots of this substance. He was seized with pain and vomiting, and died in eight hours. On dissection, the whole digestive canal was found inflamed, and the larger intestines more so than the smaller. There was, however, no gangrene, and the limbs continued flexible for some time after death.†

Two cases of poisoning with this substance, have lately been communicated to the *Societè Medicale d'Emulation* at Paris, by M. Ferrary. A domestic took a decoction of the root in some cider, at the recommendation of an empiric, and his master, from curiosity, swallowed a like dose. In about three quarters of an hour, alarming symptoms were developed, without, however, exciting suspicion of their real cause. Another glass-full was taken by the servant, when vomiting, delirium, horrible contortions, accompanied with immediate coldness, supervened, and death at last ensued. The violence of the symptoms were proportioned to the quantity taken. The master died in two hours and a half, and the servant in one hour and three quarters after its injestion. On dissection sixteen hours afterwards, the appearances in each were found precisely similar, except that in the domestic they were more strongly marked. The lungs were gorged with blood. The mucous membrane of the stomach was considerably inflamed, of a blackish brown colour, and reduced to an almost gangrenous state. The œsophagus and intestines were natural.‡

* New-England Journal, vol. 3, p. 335. Bigelow's Med. Botany, vol. 2, p. 125.

† Morgagni, vol. 1, epist. 59, p. 392.

‡ London Med. Repository, vol. 10, p. 424. As this was a quack remedy, *it is possible* that some mineral poison may have been mixed with the hellebore.

In animals, this produces vomiting, or attempts to vomit, great debility, vertigo, insensibility, and great torpor, and finally death. And this, if the dose be large enough, whether taken internally, or applied to a wound. The stomach and intestines, and particularly the rectum, are found inflamed, and in one instance, the mucous membrane was ulcerated. Slight congestions have also been noticed in the lungs, and the bladder has been observed red and thickened.*

Helleborus fœtidus is also said to have caused the death of a child, who ate its root in the pulp of an apple.†.

Bryonia dioica. (Bryony.) The administration of bryony root has caused vomiting, fainting, violent pain, profuse alvine evacuations, &c. When administered to dogs, in whom the œsophagus was tied, death ensued without any previous remarkable symptom, but the mucous membrane of the stomach was of a bright red, and the great intestines were highly inflamed.‡

Momordica elaterium. (Wild or squirting cucumber.) The expressed juice of the fruit of this plant, on standing, deposits a substance, which has been variously styled an inspissated juice, a fecula, and an extract, but is strictly speaking neither of them. It is dried, and in that state, forms the medicinal article. Among cathartics, to which class it belongs in the materia medica, it is deemed the most violent, and indeed the severity of its operation is such, that

* Orfila, vol. 2, p. 7. London Med. Repository, vol. 10, p. 426. From an analysis of the roots of black hellebore by MM. Fenuelle and Capron, they are found to yield, 1. A volatile oil. 2. A fatty matter. 3 A resinous matter. 4. Wax. 5. A volatile acid. 6. A bitter principle. 7. Mucus. 8. Alumina. 9. Gallate of potash, and acidulous gallate of lime ; and 10. A salt with an ammoniacal base. There does not appear to be any active principle in this plant. (Tilloch's Phil. Mag. vol. 60, p. 70.) It would seem that the resinous parts are supposed to be the principal seat of the lethiferous properties of this plant. (Eclectic Repertory, vol. 9, p. 344.) It is also stated that Vauquein has analyzed the *helleborus hyemalis*, and found the activity of the plant to reside in a principle contained in the oil. (Brande's Journal, vol. 13, p. 150.)

† Orfila, vol. 2. p. 11.

‡ Orfila, vol. 2. p. 13.

it has for a long time been banished from the practice of medicine. As its active principle is now however beginning to be better understood, it is probable that it may again resume its place as a drastic purgative of great power.

Elaterium, when given to the amount of three drachms to a dog, whose œsophagus had been tied, produced nausea and efforts to vomit, moaning, insensibility and death. The mucous membrane of the stomach was found highly inflamed, as was also the rectum, but the other intestines were not altered. Similar effects were produced by inserting the extract into a wound.* Drs. Clutterbuck and Paris, have particularly examined the nature of this substance. The former ascertained "that the active principle of the plant is neither lodged in the roots, leaves, flowers or stalks, in any considerable quantity; nor is it to be found in the body of the fruit itself, or in the seeds, but in the *juice around the seeds.* And the substance which spontaneously subsides from this liquor, obtained without pressure, is genuine elaterium." The quantity, however, that is contained in the fruit, is extremely small, since he only procured six grains from forty cucumbers. So violent was this article, that the one eighth part of a grain seldom failed to produce both vomiting and purging, and that often violently. The juice itself also readily inflames the skin.† Dr. Paris pursued the examination, and ascertained that not one grain in ten of the elaterium of commerce, possesses any active properties, and that decimal part is owing to a new vegetable proximate principle, which according to him, characterises this substance, and which he denominated *elatin.*‡

Cucumis colocynthis. (Bitter apple.) The only part of this plant which is used in medicine, is the dried, spongy or medullary part of the fruit. It

* Orfila, vol. 2, p. 14.
† London Med. Repertory, vol. 12, p. 5.
‡ Paris' Pharmacol. p. 270.

is well known as a drastic cathartic. Stalpart relates a case, where an individual took some of it, and was shortly after seized with the most excruciating pains in the abdomen, bloody evacuations, and violent spasms.* He also quotes cases from Tulpius, Schenkius, and Platerus, indicating its powerful operation, and mentions, that in one instance, death followed from an enema, in which not more than a drachm of colocynth had been infused.

An individual labouring under hæmorrhoids, and affected with indigestion, took two glasses of a decoction, which subsequently proved to be that of colocynth. Frequent alvine evacuations, accompanied with colic, were among the first effects; and some hours afterwards, he complained of great heat in the bowels, dryness in the fauces, and unquenchable thirst. The pulse was small and extremely rapid; the tongue red; the abdomen intolerant of pressure, and there was a very violent fixed pain in the vicinity of the umbilicus. The evacuations by the bowels had now ceased. The antiphlogistic regimen was employed, but without success. Coldness of the extremities succeeded, and he gradually sunk, after a previous diminution of the abdominal pain. On dissection, the abdominal viscera exhibited marks of the most violent inflammation. The peritoneal cavity was filled with a whitish fluid, containing flocculi of the same colour. The intestines were reddened, and thickly studded with black specks. Most of them were either adherent, or covered with adventitious membrane. The mucous membrane of the stomach was detached and ulcerated, and the peritonæum in an almost putrid condition. Traces of inflammation existed also in the liver, kidneys, and bladder.

In another case, a person labouring under quartan fever and cachexy, took the same remedy, suffered severely from it, and lost his fever. Yet he continued feeble and languid, with a leaden complexion,

* "Fateor," he observes, "profecto nunquam me tam horrenda in quoquam conspexisse symptomata." Stalpart, vol. 1, p. 173.

and died, after six months, from an attack of paralysis.*

The symptoms produced on animals by the introduction of this substance into the stomach, are in general similar to those experienced in the human subject. Dissection exhibits an inflammation of the *stomach* and *rectum*, while the great bulk of the intestines are in a natural state. No eschar was noticed.†

Stalagmitis cambogioides. (Gamboge.) This gum-resin, when introduced in quantity into the stomach of animals, whose œsophagus was tied, produced violent efforts to vomit, purging, dejection, and death. The mucous membrane of the stomach was inflamed, and some reddish spots were seen in the rectum. When this operation was not performed, and dogs were suffered to vomit, it did not cause any serious accident.

Daphne gnidium. (Spurge flax. Flax-leaved daphne.) The bark of this substance, like the poisons already noticed, excited vomiting, local inflammation and death, and the stomach also presents an appearance similar to what has been already described.

Daphne mezereum. (Mezereon.) Acts in a similar manner. Linnæus relates of a young lady, who died from hæmoptysis, occasioned by taking twelve berries of this plant.‡ Several other species are deemed poisonous. In animals poisoned by the *daphne laureola*, (spurge laurel,) Orfila observed a sanguineous effusion below the mucous coat of the stomach.‖

Ricinus communis. (Palma Christi. Castor-oil plant.) The castor oil used in medicine, is obtained by expression from the seeds of this plant. They act in a most powerful manner on the system, and

* Quoted from the 2d French edition of Orfila's Toxicology, in London Med. Repository, vol. 11, p. 162.

† Orfila, vol. 2, p. 17, 21.

‡ Orfila, vol. 2, p. 27.

‖ Audral on the morbid anatomy of the digestive tube. Journal Foreign Science, vol. 3, p. 462.

produce violent vomiting and purging. Such was also the effect observed by Orfila on animals. Thirty grains produced death in a small dog, whose œsophagus was not tied. Inflammation and ulceration were noticed in the stomach.*

Euphorbia officinarum. The stalk of this plant furnishes a milky juice, which on being dried, is called euphorbium. It is a gum-resin. Its medicinal use is solely as an errhine, and farriers employ it for blistering horses.

A female in Lincoln, (Eng.) took by mistake, eighteen days after delivery, two ounces of tincture of euphorbium, prepared with camphor, alcohol, and euphorbium. She immediately experienced a violent suffocation, burning, and pain in the throat and stomach. On the administration of warm water, copious vomiting was induced, but the pain continued for some time, nor was it relieved until after the repeated application of suitable remedies.†

In another instance, a teaspoonful was administered by a farrier in the dark, through mistake, for rhubarb. A burning heat in the throat and fauces was immediately felt, which soon extended to the stomach —an incessant vomiting of watery fluid took place; the tongue was covered with thick mucus; the pulse was very irregular, and at least 150 in a minute; and the patient was in a cold perspiration, and unable to speak intelligibly. An emetic was given, but it brought away only a small quantity of a thin black fluid; and mucilages and anodynes, when exhibited, were almost instantly rejected. The patient lived nearly three days, and on opening the body eight hours after death, there were found in the stomach several gangrenous spots, and its coats tore on the slightest touch. The spleen was much enlarged and rotten, while the vessels of the internal coat of the aorta were beautifully injected with blood, and showed marks of the highest degree of inflammation.‡

* Orfila, vol. 2, p. 29. † Case by Dr. Willis. Phil. Trans. vol. 51, p. 662.
‡ Brande's Journal, vol. 3, p. 51. Case communicated by Mr. Furnival.

When introduced into the stomach of animals, it produced violent pain and death, and the stomach on dissection, contained a red, bloody fluid, mixed with powder of euphorbium. Its coats were all of a very deep red, and the colon and rectum were highly inflamed.*

Many other species of euphorbia are poisonous, as the *E. lathyris*, the *E. cyparissias*, and the *E. tiraculli*. The second of these excoriated a man's face, on being rubbed with it, and Lamotte mentions that a glyster prepared with this plant proved fatal. In a person who allowed his closed eyelids to be rubbed with the juice of the *E. esula*, inflammation followed, and it was succeeded by the loss of the eye.† Hyder Ali, in his ferocious wars against the English in India, ordered the wells to be poisoned with the *E. tiraculli*.‡

Juniperus sabina. (Savine.) A native of Canada. Found also in the Rocky Mountains by Lewis and Clarke.

This is well known as a powerful stimulant. When administered to animals in doses of four and six drachms, it caused death, and left inflammation of the mucous membrane of the stomach, with a small ulcer near the pylorus. The rectum was somewhat inflamed. And this last was observed in every experiment.

Rhus radicans, toxicodendron, vernix. All these are natives of the United States, and the R. radicans and toxicodendron are deemed merely varieties of the same species.

The watery extract of the *radicans*, when internally administered, or applied to the cellular texture, produced a local irritation and inflammation, and after death, the mucous coat of the stomach was seen inflamed.

* Orfila, vol. 2, p. 43. It is stated that Orfila has found the mucous coat of the stomach in animals who had swallowed euphorbium, of a *very deep reddish brown*, and this appearance is sometimes observed in the human subject from corrosive poison. Journal Foreign Science, vol. 3, p. 398.

† Scopoli, quoted by Orfila.

‡ Quarterly Review, vol. 18, p. 47, *American edition.*

The juice of the *Rhus toxicodendron*, (poison oak, poison ivy,) is said by Fontana to have proved innocent to animals who were made to swallow it; but a very small portion of the milky juice applied to the human skin, excited swelling not only in the part touched, but also over the face, eyelids and ears. This was the case with our author himself. A severe burning and itching continued for several days, and small vesicles, filled with a transparent sharp humour, formed in various places over his hands. Nearly the same symptoms occurred from touching the leaves.* I may add that similar effects are very common in this country from touching this plant. Dr. Alderson even states, that sphacelation has followed, in some cases in England, of such parts of the skin as the acrid juice had touched.†

The *Rhus vernix*, (poison sumach) produces similar effects. Blindness, has been caused by merely handling it.‡ And Dr. Bigelow mentions, that he has known individuals badly poisoned in winter, from the wood of the rhus vernix accidently burnt on the fire.‖

Anemone pulsatilla. (Wind flower.) Bulliard relates the case of an old man with rheumatic gout, who applied the root of this plant bruised, to the calf of his leg, on going to bed. Cruel sufferings succeeded for ten or twelve hours, and the whole limb be-

* Med. Commentaries, vol. 12, p. 110. "The juice of the rhus toxicodendron produced enormous swellings on some labourers, in the Jardin des Plantes, wherever it touched them." Sage. Edinburgh Med. and Surg. Journal, vol. 9, p. 378.

† Med. Commentaries, vol. 20, p. 10. Mr. Van Mons has advanced an opinion that the hurtful effects of this plant depend on a gas which it exhales, during the night or in the shade, rather than on its milky juice. He seems to have proved the irritating effects of this gas. Orfila, vol. 2, p. 42. We have however too great a mass of testimony proving the nature of the juice, to allow us to consider it innoxious. Dr. B. S. Barton's account of its effects on himself, is alone sufficient. It excited itching, swelling, and vesicles, which desquamated. New York Med. Repository, vol. 8, p. 200.

‡ See an account of the poison wood tree in New England, by the Hon. Paul Dudley, F. R. S. Phil. Trans. vol. 31, p. 145.

‖ Bigelow's Medical Botany, vol. 1, p. 109. Cases are also related by Dr. Bigelow, p. 103 to 107, of the poisonous effects of the exhalations and juice of this plant.

came gangrenous, nor was it restored, until after the application of vigorous remedies. The dried root on being pounded has excited irritation of the eyes, itching and vomiting. Lastly, animals to whom the extract or the juice of the leaves had been administered, sunk under it, and exhibited the marks of violent inflammation in the stomach and rectum. The dried powder produced no inconvenience to them.*

The *Anemone pratensis, sylvestris* and *nemorosa*, are also deemed poisons. The latter produces dysentery in sheep when they feed on it.† The inhabitants of Kamschatka make use of this plant to poison their arrows, and the wounds are most commonly fatal.‡

Aconitum napellus. (Wolfsbane. Monkshood. Aconite.) Mr. Bacon, a surgeon, was called to visit a man named John Crumpler, who, at 8 P. M. had eaten some sallad in which, by mistake, a certain quantity of aconite had been put. The patient immediately felt a burning heat in the tongue and gums, and an irritation in the cheek. This tingling sensation extended over the whole body, accompanied with twitchings. When Mr. Bacon saw him, his eyes and teeth were fixed—his hands, feet, and forehead cold, and covered with a cold sweat. No pulse could be perceived, and his breath was so short as scarcely to be distinguishable. Oil and carduus tea were immediately administered, which induced vomiting, but the symptoms still remained aggravated. Ammonia was now given, when vomiting again supervened, accompanied with purging. His symptoms now improved, although the pulse was still interrupted and irregular; and he gradually recovered.‖

* Orfila, vol. 2, p. 43, 44.

† London Med. and Phys. Journal, vol. 21, p. 12.

‡ Orfila, vol. 2, p. 46. Mr. Robert extracted a fluid of an acrid taste and pungent odour, from the flowers of the *anemone pratensis*, which acted like a caustic on the tongue. Vauquelin examined and confirmed his experiments, and deems the substance a peculiar one, which is probably common to the clemates and ranunculi. It should be arranged, according to him, with the concrete oily substances. London Med. Repository, vol. 14, p. 403.

‖ Phil. Transactions, vol. 38, p. 287.

Mathiolus states, that the root of this plant was administered to four highwaymen. Two of them, after having experienced the most violent pains, were saved by appropriate means; the other two died, one of whom, a few hours after the administration, became an idiot—the face was covered with a cold sweat—asphyxia, spasms, and syncope took place—he passed involuntary stools, vomited bilious and livid matter—his body swelled, and he died apoplectic. Willis relates, that a man died mad, within a very short time after eating some sallad, in which there were some of the fresh leaves of the aconitum napellus. Even its juice introduced into a small wound made into the thumb, has been known to give rise to pains in the fingers and arms, cardialgia, lipothymia, agitation, and finally gangrene and copious suppuration.*

Effect on animals. Mr. Brodie injected an ounce of the juice of the leaves of aconite into the rectum of a cat. He soon voided it, and then stood motionless for some minutes. At the end of nine minutes, he retched and vomited, and then attempted to walk, but faltered and fell at every step, as if from giddiness. At the end of thirteen minutes, he lay motionless, except some slight convulsive actions of the limbs; and in forty-seven minutes from the time of the injection, he was dead.† Orfila gave the freshly prepared watery extract to dogs, with similar effects. The posterior extremities were entirely paralyzed, and great pain seemed to be present. When, however, he used the extract purchased in the apothecary's shops, it was slow in its operation, and required large doses to produce its usual effects.‡ The root of the plant also acts as a similar, and indeed more violent,

* Orfila, vol. 2, p. 56. Mr. Brodie states, that if a small quantity of the leaf of aconite be chewed, it occasions a remarkable sense of numbness of the lips and gums, which does not subside for two or three hours.

† Brodie's observations and experiments on the different modes in which death is produced by certain vegetable poisons, from Phil. Trans. 1811, in Eclectic Repertory, vol. 2, p. 273.

‡ Orfila, vol. 2, p. 52. This corresponds with the following fact, mentioned in a late journal. Ten patients, threatened with phthisis, were re-

poison to animals. Wepfer destroyed a wolf with two drachms of it, and Bonetus, a young dog with half a drachm.

When applied to the cellular texture of animals, by Brodie and Orfila, the symptoms were very similar to those previously described. On dissection, the stomach and brain were generally seen healthy, although in a few cases, the mucous membrane of the former was slightly inflamed. In another instance, the rectum exhibited a few reddish spots.

The *Aconitum cammarum* is said to be no less deleterious than the napellus, and cases of death from its use are related by Mathiolus and Bonetus. In an instance mentioned by the former, vertigo and violent commotion of the brain preceded a general swelling of the body—the countenance became livid, and the patient died in horrible convulsions.

The *Aconitum anthora* and *Aconitum lycoctonum*, (wolfsbane,) are also deemed poisonous.*

Œnanthe crocata. (Hemlock dropwort.) Several cases are on record of the poisonous effects of this plant. A citizen of the Hague ate, with one of his friends, some of its roots. In a short time, they both felt a great heat in the stomach, which was followed by alienation of mind, vertigo, cardialgia, nausea and diarrhœa. One of them had violent convulsions, the other bled at the nose; and the one who had eaten the most, died at the end of two hours, and the other at the end of three.†

ceived into the hospital at Pavia, and the extract of aconite was prescribed for them. They took this to the amount of *half a drachm at a dose*, without any inconvenience, and indeed with improvement. All the extract, however, prepared in the hospital, being consumed, a fresh quantity was procured from the shop of an apothecary, and administered in similar doses. Mental affections of the most alarming nature rapidly supervened, accompanied with other distressing symptoms. Borda prescribed laudanum as a *contra-stimulant*, and the patients were gradually restored. London Med. Repository, vol. 15, p. 540.

* Linnæus, however, mentions, that he was informed by the wife of the principal clergyman of Lulea, that at a certain post-house in Lapland, she had seen large quantities of the *aconitum lycoctonum* collected and boiled for the use of the table, like cabbage! She was evidently acquainted with the plant. Linnæus' Tour in Lapland, vol. 2, p. 123.

† Stalpart, vol. 1, p. 182. Our author quotes cases from Smetius, Roes-

Eleven French prisoners walking about the town of Pembroke, gathered and ate by mistake a small quantity of this plant with bread and butter. One of them was shortly after seized with convulsions, and died, in spite of every effort to save him. The others were attacked in a similar manner, of whom one died, and the other was relieved by forcing down an emetic. None experienced any heat at the stomach.*

M. Charles visited a family who had eaten the roots of the œnanthe. A sensation of burning was present in the stomach, and small rose coloured spots appeared successively in different parts of the body. The abdomen in one case was greatly swollen. Several soldiers are also said to have died from eating them. The previous symptoms were nausea, vertigo, vomiting, and violent convulsions. Death ensued in less than an hour after using the poison. On dissection, the lungs were found distended, and their vessels full of black and dissolved blood. The bronchiæ, trachea and mouth contained a frothy and whitish fluid. The stomach was contracted and inflamed in its extremity and lesser curvature; its coats were thickened; the intestines were puffed up, and their vessels injected. The derangements were precisely similar in all the cases; and the body of one, though preserved four days, exhibited no sign of putrefaction.†

Œnanthe fistulosa, has also frequently proved poisonous.

Ranunculus acris. (Butter cups.) Its leaves are an acrid and irritating external application, producing inflammation and ulcers. Internally given, the juice of its leaves produced inflammation of the mucous membrane of the stomach.

Ranunculus sceleratus, (Water crowfoot) excited

lerus, and Timæus, in which the root produced vertigo and violent delirium, and in some instances difficult respiration and hiccup.

* *Howell*, in Phil. Trans. vol. 44, p 227, with the remarks of Mr. Watson. See also cases of its poisonous effects by Dr. *Vaughan*, in Phil. Trans. vol. 20, p. 84; by Dr. *Watson*, vol. 50, p. 856, and by Dr. *Pulteney*, vol. 62, p. 469.

† Duval, quoted by Orfila, vol. 2, p. 67.

severe pains and convulsive movements in Krapf, although he took only a single flower which he had well pounded. Its leaves and juice excoriated the tongue and mouth, and produced burning pain in the œsophagus. Plenck destroyed a dog with its juice, and found the stomach red and corroded, and the pylorus tumefied. Externally applied, it produces extensive ulcers.

Ranunculus flammula, has often destroyed whole flocks of animals, from grazing on it in the spring.

Ranunculus arvensis, poisons sheep, and three ounces of its expressed juice killed a dog in four minutes.*

Several other species are equally poisonous, as the *bulbosus, ficaria, alpestris, aquatilis*, &c.†

Colchicum autumnale. (Meadow saffron.) This plant acquired considerable celebrity some years since, from its being supposed to be the active ingredient in the *Eau medicinale* of Husson.

Its seeds have proved fatal to several children, in consequence of eating them, and cattle also suffer greatly by them, but only in the *spring*, when the seed vessel is fully matured. The seed, if swallowed, adheres to the coat of the stomach, and produces at the several points of adhesion, spots of inflammation, which occasion the death of the beast.‡

The following is an instance of its poisonous effects on man. An ounce and a half of the vinous tincture of colchicum was by mistake given to a feeble man, aged fifty-six, and labouring under chronic rheumatism. No complaint was made until about an hour after, when retching and acute pains at the

* Lond. Med. and Phys. Journal, vol. 21, p. 12.

† The ranunculus acris, sceleratus, flammula, bulbosus, and aquatilis, are natives of the United States.

‡ Mr. Want, in the Annals of Philosophy, vol. 4, p. 281, from information communicated to him by Sir Joseph Banks and Mr Andrew Knight. In the Edinburgh Annual Register, vol. 7, p. 114, it is mentioned that a farmer near Tetbury, lost seven yearling beasts out of eighteen, by putting them in a pasture where this plant grew in abundance. On opening their bodies *the food was found clogged together, in a crude and undigested mass, incapable of passing through the proper ducts.* The French call it, among other names, *tue chien*, from its killing dogs

stomach came on, and vomiting and purging supervened. This state continued for nearly twenty-four hours, when the purging ceased, but the most distressing nausea continued, with frequent retching. The stools were, during the succeeding night, often involuntary, but not bloody. Excessive thirst came on and continued till death, with severe pains of the stomach and bowels. In the evening, the patient seemed nearly exhausted; delirium appeared; the pulse could scarcely be perceived. He lived however through the second night, but died the morning following. On dissection, there was a redness of the stomach observed, but no appearance of inflammation in the bowels.*

In addition to the vegetables already noticed, I may briefly add the following:

Chelidonium majus, (celandine,) produced death in animals, both when introduced into the stomach and when applied to wounds. In the former case the stomach was found inflamed, but not in the latter. The wounds however, were inflamed and livid, and in both modes of application, the lungs were seen livid and distended with blood. This plant is naturalized in this country. The *chelidonium glaucium* has caused delirium and purging in a family, who eat of a pye in which it had by mistake been put.†

Delphinium staphysagria. (Stavesacre.) An ounce of this substance introduced into the stomach of a dog, whose œsophagus was tied, caused dejection, but neither vertigo or convulsions, and death succeeded in fifty hours. The mucous membrane of the stomach was inflamed, but the other organs presented no alteration. When applied to a wound in a moistened state, it induced dejection, vertigo, and finally death. The wound was inflamed and the limb

* Edinburgh Med. and Surg. Journal, vol. 14, p. 262. I have already, (Page 371) mentioned that the vegetable alkali, termed *Veratrine*, has been detected in the root of this plant.

† Phil. Transactions, vol. 20, p. 263.

greatly swelled, but the digestive canal was sound. Its local effects are evidently the most striking.*

Narcissus pseudo-narcissus. (Meadow narcissus, daffodil.) The extract of this plant, whether externally or internally applied, produced violent vomiting or attempts to vomit. Death shortly ensued, and in every instance the mucous membrane of the stomach was inflamed, and in several, that of the rectum.

Gratiola officinalis. (Hedge hyssop.) Death followed after a considerable interval, from the introduction of the extract of this substance into the stomach of animals, and the mucous membrane was inflamed. The same result followed from inserting it into a wound, but the stomach was sound.

Jatropha curcas. (Indian nut.) The seeds of this plant act as a violent poison, and excite vomiting, insensibility, great weakness and death. Violent inflammation was found in the mucous membrane of the stomach and intestines. It was more active in its operation, when introduced into the stomach, than when applied to the cellular texture.

The fresh root or the juice of the *Jatropha manihot* has been long known as a violent poison.† It produces swelling of the body, nausea, vomitings and purgings, pain, tenesmus, loss of sight, coldness of the extremities, faintings and death.‡

Scilla maritima. (Squill.) This is ranked by Orfila among the poisons. In considerable doses it produced death, when given internally, and the œsophagus tied ; or when applied externally. The digestive canal however was always sound.

* Lassaigne and Fenuelle have lately discovered an alkali in the seeds of this plant, which they denominate *Delphine*. It appears to exist in combination with malic acid, and when pure, is described as extremely acrid. Edinburgh Philosophical Journal, vol. 1, p. 418. Annals of Philosophy, vol. 16, p. 32.

† See Piso, quoted by Orfila, vol. 2, p. 73, and Philosophical Transactions, vol. 2, p. 634.

‡ Humboldt states, that there are two kinds of *juca*, which furnish the cassava or manihot. The root of the *juca dulce* is perfectly innocent, but that of the *juca amarga* or bitter manihot conceals a deadly poison. Heat however, will destroy its noxious qualities. Edinburgh Review, vol. 16, p. 245, American edition.

Sedum acre. (Houseleek. Wall-pepper.) This produced death when given internally, and the mucous membrane of the stomach was seen of a fiery red colour.

Rhododendron chrysanthum. The decoction of this plant has an acrid, burning taste ; it is emetic, drastic, and inflames the texture to which it is applied. The *rhododendron ferrugineum* is said to be equally poisonous. Welsch speaks of a meal which became fatal to the guests, from having eaten of a hare which had been fed upon its leaves.

Fritillaria imperialis. (Crown imperial.) It is deemed a poison by some, but in the experiments of Orfila, death did not ensue until several days, and no lesion was remarked in the digestive canal.

Pedicularis palustris, has an acrid, burning taste, and is said by Gleditsch and Gunner to have injured sheep and oxen.

Cyclamen Europæum. A violent cathartic, and it also excites vomiting. Bulliard states, that its root produces cold sweats, dizziness, and convulsive movements—the patient voids blood by vomiting and by stool ; and a super-purgation supervenes, which proves fatal.

Plumbago Europæa. Sauvages observes, that the workmen who make use of the decoction of this plant for the purpose of obtaining a yellow dye, are tormented by a severe headache if they work longer than six hours. Its taste is acrid and almost caustic.

Convolvulus scammonea. (Scammony.) The experiments of Orfila contradict the opinion of some toxicologists, that the juice of this plant is poisonous. He frequently administered four drachms of it to dogs, who had the œsophagus afterwards tied, and he only observed alvine evacuations. They lived six or seven days.

Cerbera ahovai. The nut of the fruit of this plant is deemed highly deleterious, as also the fruit of the *Cerbera mangkas.*

Cynanchum erectum. Plenck relates, that thirty-

six grains of the leaves of this plant administered to a dog, produced violent vomiting, a trembling, convulsions and death. The *Cynanchum vimiale* furnishes a milky juice, extremely caustic.

Lobelia syphilitica. (Cardinal flower.) A native of the United States. This is an acrid plant, and acts as an emetic and purgative.

The *Lobelia longiflora* possesses still more energetic properties. In Spain, according to Orfila, it is called *Rabienta cavallos*, because it kills horses.

Lobelia inflata. (Indian tobacco. Emetic weed. Eye-bright.) A native of the United States. This is a powerful emetic, and distressing and long-continued sickness often accompanies its operation. "A melancholy instance of death occasioned by the use of this plant, in the hands of a quack, is detailed in the sixth volume of the Massachusetts Reports, in the trial of Samuel Thompson, an empiric practising in Beverly, for the murder of Ezra Lovett. In this trial, it appeared that the patient, being confined by a cold, sent for the pretended physician, who gave him three powders of lobelia in the course of half an hour, each of which vomited him violently, and left him in a great perspiration during the night. The next day two or more powders were administered, each of which operated by vomiting, and occasioned great distress. In like manner, two other powders were given the subsequent day, leaving the patient in a state of great prostration. Several days after this, the physician came again, and finding his patient still worse, administered several more powders, which occasioned great distress, and at length ceased to operate. Finding that the stomach was not sensible to the emetic effect of the lobelia, the physician repeated the dose, and when the patient complained of great distress at the breast, and said he was dying, the doctor assured him the medicine would soon get down, or operate as a cathartic. However, on the same evening, the patient lost his reason, and became convulsed, so that two men were required to hold

him. To relieve which, the doctor forced down two more of his powders, and the patient, as was to be expected, grew worse, and continued so until he expired.

The doctor, who had thus terminated the disease and the patient at once, was arrested and put upon trial for murder; but the homicide proving a legitimate one, from the want of a sufficient evidence of malice prepense, he was acquitted and set at liberty."*

Horses and cattle have also been killed from eating this plant.

Several species of *Apocynum*, as the *androsæmifolium*, *cannabinum* and *venetum*, furnish an acrid milky juice, which inflames and ulcerates the skin. The first and second of these are American plants.

Asclepias gigantea. Bauhin asserts, that the juice of this given in the dose of a drachm and a half, has produced violent symptoms, and a fatal hæmorrhage. When Orfila administered to dogs, the *Asclepias vincetoxicum*, the animals died at the end of one or two days, and their stomachs were found inflamed.

Hydrocotile vulgaris. (Marsh pennywort.) This plant has an acrid taste. It is a native of the United States.

Clematis vitalba. (Virgin's bower.) *Clematis flammula, erecta,* and *integrifolia.* These are all acrid and caustic. When applied to the skin, they produce redness, pustules, and excoriations; introduced into the stomach, they occasion an inflammation, which destroys the animal.

Pastinaca sativa. The root of this plant is said by Murray to have produced delirium, vertigo, heat at the stomach, and in the mouth and eyes, with tumefaction of the lips. It is a native of the United States.

* Bigelow's American Botany, vol. 1, p. 181. Tyng's Massachusetts Reports, vol. 6, p. 134. Commonwealth v. Thompson.

The *Sœlanthus quadragonus, forskalii* and *glandulosus,* are very acrid, and are deemed poisonous.*

Calla palustris. (Water arum.) A native of the United States. The root of this plant has a burning taste.

Phytolacca decandra. (Poke. Pigeon berries.) A native of the United States. Its juice is acrid, and acts as a violent emetic and purgative. Prostration of strength and convulsions have also been induced by it. On a dog, to whom two ounces of the liquor distilled from the berries were given, Dr. Schultz of Pennsylvania, found it to produce nausea and drowsiness, with slight spasmodic motions, but no vomiting. This last is, however, a common effect.†

Croton tiglium. The seeds of this plant have an acrid, nauseous and burning taste. They were formerly employed as hydragogue purgatives, but on account of the violence of their operation, were completely laid aside. One seed is sufficient for a dose, and even this sometimes excites violent purging and vomiting.‡

Within a few years past the expressed oil of this plant has come into considerable use as an article of materia medica. From one to three drops is a dose,§ and tremors and delirium have been known to occur in a male patient from a dose of two drops.‖

Arum maculatum, (Wake robin) *A. dracunculus, dracontium, seguinum, triphyllum,* and other species. The third and fifth are natives of the United States.

These are all acrid, and have produced dangerous

* Orfila, vol. 2, p. 83. I must remark, that I cannot find any plant of this name either in Linnæus or Persoon.

† Bigelow's Amer. Med. Botany, vol 1, p. 48.

‡ See Edin. Med. and Surg. Jour. vol. 13, p. 256. Further proofs of its violent action are mentioned in a paper by Mr. Frost, (from the Lond. Med. Repository,) in the Amer. Med. Recorder, vol. 5, p. 615.

§ According to Dr. Nimmo of Glasgow, the kernels of the seeds of the Croton are composed of 37 parts of acrid purgative principle, 33 of fixed oil, and 40 of farinaceous matter in the hundred. The oil itself consists of 45 acrid principle, and 55 fixed oil. Brande's Journal, vol. 13, p. 62. See also Quart. Jour. Foreign Med. and Surg. vol. 4, p. 288.

‖ Dr. Francis. MS. Communication.

effects. When the fresh root of the A. maculatum was given by Orfila to dogs, they died at the end of from twenty-four to thirty-six hours, without any other symptom than dejection, and the digestive canal was found somewhat inflamed. Bulliard relates the following case: "Three children ate of the leaves of this plant. They were seized with horrible convulsions, and with two of them all assistance was unavailing, as they could not be made to swallow any thing. They died, one at the expiration of twelve days, and another at the expiration of sixteen. The third was saved with difficulty. Its tongue was greatly swelled, and hence deglutition was painful and difficult."*

To these, I will take the liberty of adding, *Equisetum hyemale.* (Scour grass.) A native of the United States.

This is said to be fatal to horses who eat it, and on examination, the stomachs are found cut and lacerated by the plant.†

Tanacetum vulgare. A naturalized plant. *Oil of tansy.* Dr. Francis mentions that a pregnant female lost her life in 1816, at New-York, from taking half an ounce of it. Great pain and anxiety about the epigastrium were experienced until her death, which happened within a few hours.‡

Symplocarpus fœtida. (Salisbury.) *Ictodes fœtidus* (Bigelow.) (Skunk cabbage.) A native of the United States.

This plant emits a very pungent odour from the spathe and flower. Dr. Barton was seized with inflammation of the eyes, in consequence of the necessary examination which he gave to it.§ A dose of

* Orfila, vol. 2, p. 83.

† Barton's Med. and Phys. Journal, vol. 1, part 1, p. 149. Our author remarks that its fatality is attributed by some, to the cylinders of ice contained in its stem. Sir George Mackensie, in his travels in Iceland, p. 420, states, on the authority of Dr. Hooker, that this plant is used as excellent food for horses in that Island.

‡ New-York Med. and Phys. Journal, vol. 2, p. 27.

§ Dr. W. P. Barton's Medical Botany, *article* Symplocarpus.

thirty grains of the root has caused vomiting, headache, vertigo, and temporary blindness.*

As to the *treatment* of persons who have taken poisons of this class, I can only offer general directions. Vomiting and the evacuation of the deleterious substance are to be encouraged by mucilaginous drinks. If inflammation be dreaded, the antiphlogistic regimen is proper. Coffee is recommended by Orfila, in cases where considerable stupefaction ensues.

I shall conclude the examination of this class of vegetable poisons, with the notice of a substance, derived from vegetables, and from vegetable products; viz. the

OXALIC ACID.

Numerous deaths have occurred in England within a few years, from the administration of this substance. It was generally taken in an accidental manner, having been mistaken for the sulphate of magnesia, a salt which it resembles in external character. The facility of the occurrence of these accidents is increased from the circumstance, that it is frequently applied to several domestic purposes, such as the cleaning of leather, and the removal of iron-mould and ink-spots.

The cases substantiating the deleterious effects of oxalic acid, are contained in the leading periodical publications of the day, and from a comparison of these, I am enabled to present the following account of its effects.†

* Bigelow's Medical Botany, vol. 2, p. 48.

† I may premise, that after I had prepared the article on this poison, and within a few days before it was required by the printer, I received the Edinburgh Med. and Surg. Journal for April, 1823, which contains an elaborate and valuable paper on *poisoning by oxalic acid*, by Professor Christison and Dr Coindet. These gentlemen have investigated its effects on animals, and its chemical habitudes, with great ability, and I have been much indebted on these points to their examinations.

With these preliminary remarks, I observe, that the following cases have been noticed in preparing the accompanying article:—1. Case by Mr. Royston. London Med. Repository, vol. 1, p. 382. 2. Do. by *Mr. Roberts.* Ibid. vol. 3, p. 380. 3. Do. by *Mr. George Johnson.* Ibid. vol. 6, p, 474. 4. Do.

When the solution is strong, (and this is usually the case, from its being mistaken for epsom salts,) its corrosive nature is such as to excoriate the mouth in a violent manner. A young man purchased some for the purpose of committing suicide, but its extreme pungency made him hesitate in swallowing it, while it was yet in his mouth. His life was thus preserved, but a most dreadful excoriation of the tongue, mouth and gums, was the consequence.* So also in Mr. Fraser's case, the tongue was greatly swollen, and had the appearance of being scalded. I do not, however, find any notice of this in the other cases, probably because the solution was diluted, or (which is more likely) taken down at a single swallow.

Death ensued with great rapidity—in forty minutes in one case, and in fifteen minutes in two others. A few hours is generally the term. The patient under the care of Mr. Fraser, however, survived several days, and finally died of the secondary effects. As this case is peculiar, I shall notice it at length hereafter.

Violent and most acute pain, excessive vomiting of a dark-coloured or sanguineolent fluid, catharsis, a pulse imperceptible at the wrist, and a sunken countenance, indicating the nearness of death, seem to be the symptoms observed.

Appearances on dissection. These indicate the presence of a powerful acid. In Mr. Royston's case, where the subject was a female, who died in forty minutes, the villous coat of the stomach was injected with blood, and florid over its whole surface. Patches

by *Mr. Williams.* Ibid. vol. 11, p. 20. 5. Do. by *Dr. Smith.* vol. 12, p. 18. 6 & 7. *Two cases* in Edinburgh Med. and Surg. Journal, vol. 13, p. 249 8. Case by *Mr. W. W. Fraser.* Edinburgh Med. and Surg. Journal, vol. 14, p. 607. 9. Case of *Michael Dillon,* in Cooper's Tracts on Medical Jurisprudence, p. 449, from a London paper.

To these, Drs. Christison and Coindet add cases from the Dublin Hospital Reports, from Dr. Percy's Inaugural Dissertation, and from the London Courier. Probably the last is the case quoted by Dr. Cooper. If so, we have eleven cases on record, nine of whom proved fatal, and only two recovered; and these nine cases (all accidental) occurred within two years and a half, in England. Brande's Journal, vol. 3, p. 49

* London Med. Repository, vol. 7, p. 526.

of an extraordinary intensity were also noticed. In other cases the coat was entirely corroded, and indeed the stomach perforated, so that its contents had escaped into the cavity of the abdomen. The œsophagus of one individual was so injured, that its cuticular coat peeled off with the slightest effort.*

The intestines sometimes partook in the inflammation and contraction, and at other times not. But the viscera of the thorax and the brain do not appear to have been diseased in those cases where their examination is noticed.

In the case related by Mr. Fraser, an individual took half an ounce of oxalic acid in solution, instead of salts. He instantly became conscious of the mistake, from perceiving the acid taste. Pain and vomiting ensued, and although they were mitigated in some degree by alkaline remedies, yet they recurred with violence. Spasms, impeded respiration, and general numbness were complained of; the pulse was scarcely perceptible at the wrists or temples; the extremities were cold, and the matter vomited became tinged with blood. After a short time, he brought up a large quantity of blood. Diluents were freely administered, together with anodynes, and his situation gradually became more tolerable. Numbness, however, occasionally occurred, and was relieved by warm applications, and a drink of sago and wine. On the second day, vomiting, retching, spasms, and singultus supervened; the pulse was nearly 100, and feeble, and numbness and chillness of the feet were present. A repetition of previous remedies gradually moderated these, but the hiccup continued for several days. On the sixth day, he felt himself so well as, contrary to directions, to ride out in a gig. After this, debility came on gradually; an eruption appeared over the whole body, and hiccup was occasionally present. He retained his senses until the

* "A quantity of a dark-coloured fluid, resembling coffee-grounds, and probably consisting of extravasated blood altered by the poison, was generally found in the stomach." Christison and Coindet.

day before his death, and complained often on swallowing any article which was not perfectly bland. He expired fourteen days after taking the poison, in a state of perfect exhaustion.

On dissection, the stomach and a small portion of the intestines presented the marks of inflammation: the villous coat was completely destroyed, and this abrasion extended upwards throughout the whole of the œsophagus, exposing the muscular coat. In some parts the villous coat seemed entire, but on examination, it was found to be soft, and easily rubbed off with the finger or sponge. The muscular coat of the stomach and œsophagus was much thickened, highly injected, and exhibited a dark gangrenous appearance. No perforation of the stomach was observable.

The small intestines exhibited similar appearances, but partially and in a lighter degree. The other viscera were healthy.

Effect on animals. On this point, we have the experiments of Mr. A. T. Thomson, and those of Drs. Christison and Coindet. The former gentleman produced death in a very few minutes, by introducing from ten grains to half a drachm into the stomachs of rabbits and dogs. Convulsive movements generally preceded the fatal termination, and on dissection, the stomach was found very rotten, diaphonous and pulpy to the touch, and its blood vessels enlarged and very black. The mucus contained in it was coagulated. The lungs were inflamed, and the blood found in the lungs, heart, abdomen, and the frothy fluid found in the bronchial cells, showed traces of an acid. The œsophagus and pharynx were healthy.*

In the experiments of Christison and Coindet, the œsophagus was tied in every instance, and the violence of the efforts to vomit was directly in proportion to the quantity of the poison. Death however, always succeeded after a short interval. On dissec-

* London Med. Repository, vol. 3. p. 383.

tion the stomach was found filled with the dark coloured fluid already noticed, when speaking of the examinations of the human subject, and which is evidently extravasated blood acted on by the acid. The internal membrane of the stomach was always of a deep cherry-red colour, and generally streaked with lines of black, granular extravasation. The degree of corrosion induced appears to depend on the strength of the acid.

When portions of a dead stomach were submitted to the action of a saturated solution, the mucous epidermis separated, and appeared thickened and brittle. After some hours the villous coat was also acted upon and in two days, it was brittle and easily scraped off, and the other tunics were softened, swollen, and translucent. It thus evidently exerts a powerful chemical action on the organs concerned.

These observers also noticed, that a small quantity of acid, when diluted, destroys an animal much sooner than when concentrated, and on dissection, no unnatural appearance whatever could be detected in the stomach, excepting a slight cineritious tint of the mucous epidermis.

The result drawn from their numerous experiments is, that oxalic acid in most circumstances acts through the medium of absorption. They could not however detect its presence in any of the fluids.*

Tests. (a) Taste the suspected substance—if it be oxalic acid, it is very sour; if epsom salts, very bitter and saline.

(b) Litmus and blue sugar-loaf paper are reddened by the acid, but not affected by the salts.

(c) Take a little writing ink and drop it on one or two of the suspected crystals. If they be epsom salts no alteration will occur, but if oxalic acid be present, the ink will become of a reddish brown, and no longer appears as ink, since the acid dissolves the black oxide, and forms oxalate of iron.† These tests are

* Edinburgh Med. and Surg. Journal, vol. 19, p. 163 to 186.
† Quarterly Journal, Foreign Med. and Surg. vol. 5, p. 152.

principally valuable as precautionary ones. Drs. Christison and Coindet recommend the three following to be used on all suspected fluids found either in the stomach, or vomited.

(d) Decolorize the fluid, if necessary, with chlorine. The hydrochlorate of lime, if the solution contains oxalic acid or oxalate of lime, will throw down an insoluble oxalate of lime. But it also precipitates with the carbonates, sulphates, phosphates, &c. This then is to be distinguished by the following experiments: The nitric acid will not take up the sulphate of lime, but a few drops of it dissolved the oxalate. The hydrochloric (muriatic) acid will not dissolve the oxalate, unless in very large quantity, while two or three drops will take up the carbonate, phosphate, tartrate, or citrate.

(e) Decolorize as before, and add sulphate of copper. It precipitates oxalic acid bluish-white, and the oxalates pale-blue. The only objection to this is, that it precipitates the carbonates, and throws down the phosphoric acid, whether free or combined. The muriatic acid must be here again used as above.

(f) Nitrate of silver gives a heavy white precipitate. With oxalic acid, and still better with the oxalates; and this precipitate, when dried and heated over a candle, becomes brown on the edge, then of a sudden fulminates faintly, and is all dispersed in white fumes. This is deemed a very delicate test, as from a quarter of a grain dissolved in 4000 parts of water, the experiments procured enough of the powder to show its fulmination twice.

These tests are very little influenced by the presence of such animal matter as may exist in the suspected fluid, after boiling and filtration. The chief animal principle then present is gelatine, and neither the hydrochlorate of lime, sulphate of copper, or nitrate of silver, precipitate it alone. They therefore, and especially the two first, will not be affected by its presence, but when it is present in very large proportion, it suspends the action of nitrate of silver.

If magnesia or chalk has been used as an antidote, boil the powder in pure water, and then subject the filtered liquor to the three tests already described.*

Antidotes. Death is generally so sudden in these cases, that but little can be done.

Mr. Thomson recommends a mixture of chalk and water to be given as soon as possible. Oxalate of lime will thus be formed in the stomach.† Magnesia may also be advisable. The alkalies should not be given, as Christison and Condet found death to follow in animals from the exhibition of the oxalates of potash and ammonia, in a few minutes.

Should the patient be so fortunate as to recover from the immediate effects, it will be advisable to employ stimulants, as brandy, friction, and hot fomentations.

It has been supposed that *Tartaric* and *Citric acids* in large quantities, would act in a similar manner on the human system.

2. Narcotic poisons.

Narcotic poisons are defined by Orfila to be those which produce stupor, drowsiness, paralysis or apoplexy and convulsions.

opium.

This substance is the inspissated juice of the *Papaver somniferum*, or common white poppy, obtained by incision into the capsules when they have arrived at a certain state of maturity. Its appearance and character are well known, and I shall hence not enlarge upon them at this time. It has also been ascertained within a few years, that it is a very compound substance, consisting, according to the latest examinations of chemists, of the following constituents: resin, gum, bitter extractive, sulphate of

* Edin. Med. and Surg. Jour. vol. 19, p. 198, 199.

† Lond. Med. Rep. vol. 3, p. 388. A case, in which this evidently proved serviceable, is related in the same work, vol. 12, p. 18.

lime, gluten, and three new bodies, *narcotine, morphia* and *meconic acid.* Of these, I shall give some account in the note, but in my present remarks, shall confine myself principally to a consideration of the poison in its compound state.*

Symptoms. When opium or laudanum are taken in large quantities, the following symptoms are usu-

* Derosne appears to have been the first of modern chemists who analyzed opium with success. He found in it in 1803, a crystallizable substance, which was styled after him the *salt of Derosne.* In 1817, the discoveries of Sertuerner, of Eimbeck, in Hanover, were published. He announced a new alkaline body, *morphia,* and a new vegetable acid, the *meconic.* Morphia was obtained by him, by digesting opium with distilled water for a considerable time, and then adding ammonia in excess. A precipitate was caused, which formed into crystals, and these crystals were impure morphia. As to its action on the human system, it may be remarked, that when uncombined, it had little effect, on account of its insolubility; but when dissolved in alcohol, half a grain produced a general redness over the body. Three half grains taken within an hour, caused a sense of weakness, faintness, and a general stiffness. Meconic acid is also obtained from the liquor precipitated by the ammonia. This he found did not produce any sensible effects, as he took five grains without any inconvenience.

Robiquet shortly after published a new process for obtaining morphia, viz. boiling the opium with magnesia. This leaves a precipitate, which is boiled with alcohol, and the latter menstruum dissolves the morphia. Orfila and Magendie now examined this substance and its compounds. Twelve grains of morphia introduced into the stomach of dogs, produced no sensible effect, while the same quantity of the watery extract of opium caused violent symptoms of poisoning, and sometimes even death. This inertness is owing to its insolubility, but when dissolved in vinegar or in oil of olives, it acts as a powerful and ready poison.

A new experimenter afterwards presented the result of his investigations, viz. M. Robiquet. As the investigations of Magendie had shown that the salt of Derosne (or *narcotine,* as Robiquet styled it) produced a stupor differing from real sleep, and acted as a poison on dogs in small doses, he conceived that he might render opium a more soothing medicine, by depriving it of this irritating principle. And accordingly after macerating the opium in water, he evaporated it to a thick syrup, and then treated it with ether. This etherous tincture is submitted to distillation as long as crystals of narcotine are obtained. When the ether has no longer any action on the extract, he evaporates the solution, and the opium is prepared.

As these experiments were in opposition to the conclusions of Orfila, the latter undertook several new experiments, in order to settle the question, and he has satisfied himself of the following results:—1. That opium owes its venomous qualities to the morphia, as well as to the salt of Derosne, which it contains. 2. That these two compounds act very differently on the human economy, 3. That the known action of opium is the result of the combination of these two compounds. 4. That the toxic quality of opium must be attributed principally to the morphia, since the extract deprived of the salt of Derosne, kills the animals in the same space of time as the common extract.

For further information on this interesting subject, I must refer to the following works, from which the above abstract is collected. London Med. Repository, vol. 8, p. 433; vol. 9, p. 332. Edinburgh Med. and Surg. Journal, vol. 18, p. 151. Brande's Journal, vol. 12, p. 311. Chapman's Journal, vol. 3, p. 187; vol. 5, p. 45. Annals, vol. 12, p. 55; vol. 13, p. 153. Quart. Jour. For. Med. and Surg. vol. 3, p. 250 to 254.

ally observed within a short time : insensibility and immobility, respiration scarcely perceptible, and a small and feeble pulse, which sometimes becomes full aud slow. As the effects increase, the lethargic state becomes more profound, deglutition is suspended, the breathing is occasionally sterterous, the pupils are insensible to the application of light, the countenance is pale and cadaverous, and the muscles of the limbs and trunk are in a state of relaxation. Vomiting sometimes supervenes, and there is an occasional glimpse of returning animation, but the comatose state soon returns, and death, which is often preceded by convulsions, rapidly follows.

The bladder is sometimes unable to contract on its contents, and attempts to empty it prove useless.* While again in cases of recovery, such a weakness will be left in the lower extremities, and approaching so near to paralysis, that it cannot retain its contents.†

Two instances are mentioned in which vomiting was *the sole effect* induced from taking large quantities of opium. In one case, an ounce of laudanum was swallowed at midnight, the individual went to sleep, and shortly after rising, began to vomit, and continued doing so during the day. The next day he was well. In the other, three ounces produced, after a few hours, a similar result.‡

On its effects, when taken as a substitute for spirituous liquors, it is not necessary for me to dilate. The Turks, as is well known, are of all nations the most generally attached to its use, and the following description of the *Teriakis*, or opium eaters, of Constantinople, fully explains the consequences. "Pale, emaciated, and ricketty, sunk into a profound stupor, or agitated by the grimaces of delirium, their persons are after the first view, easily to be recognized, and

* See case by Mr. Cornish, London Med. and Phys. Journal, vol. 31, p. 193, and also a case, Ibid. vol. 28, p. 80.

† An instance of this kind by Mr. Murley, is quoted in the Eclectic Repertory, from the London Med. Review for October, 1811.

‡ London Med. Rep. vol. 9. p. 525. vol. 10, p. 175.

made an impression too deep to be speedily erased. The increasing attachments for wine has diminished the consumption of opium, but there are still Teriakis who will swallow in a glass of water, three or four lozenges, amounting to one hundred grains."*

There is however one point connected with this subject, which deserves serious notice. I allude to the practice so much in vogue, of administering paregoric, laudanum, Godfrey's cordial, and other preparations of opium to infants of a tender age. The consequences are costiveness—a pallid countenance —tremulous and often convulsive motions—emaciation—stupor or fretfulness. The stomach becomes disordered, vomiting occasionally supervenes; the stools are dark coloured and fœtid, and a perfect state of atrophy is present before death closes the scene. These are the effects of a continuance of this most pernicious treatment, and it is to be feared that it prevails very extensively. Dr. Clarke, at Nottingham, in England, stated some years since, that in that town alone, upwards of two hundred pounds of opium, and above six hundred pints of Godfrey's cordial were annually retailed to the poorer class.†

Appearances on dissection. Although the cases are numerous of death by this poison, yet the examinations of the body have been few and imperfect. If taken in large quantity, some portion of it will generally be found in the stomach or intestines.‡ But the condition of these organs is usnally not much varied from the healthy state.

In a case already mentioned, the body was covered with red brown patches on the arms, shoulders and

* Hobhouse's Albania, vol. 2, p. 944. London edition. See also Philosophical Transactions, vol. 19, p 288.

† Edinburgh Med. and Surg. Journal, vol. 4, p. 271, and vol. 12, p. 423.

‡ I say *generally*, but there are several cases mentioned, where none could be discovered after death, as in the case of a soldier, who took two drachms of opium, and died in six hours and a half. London Med. Repository, vol. 14, p. 426. See also Edinburgh Med. and Surg. Journal, vol. 19. p. 196. Case related by Dr. Christison, and London Med. and Phys. Journ vol. 31. p. 193. Case by Mr. Cornish.

nucha, the day after death, the face was pale, and the mouth filled with froth. There was a general congestion of black blood in the brain; the dura mater was injected, and even the capillaries gave out on incision, minute drops of black blood. The heart was filled with the same, as were the lungs, and the bronchiæ were reddish. The stomach was swollen, and had red-brown patches at its fundus. The intestinal mucous membrane was minutely injected—being the effect of congestion and not of inflammation. The liver and spleen were gorged with blood, and the bladder and kidnies sound.*

In Mr. Stanley's case, related in the Transactions of the London College of Physicians, water was found in the cellular tissue of the pia mater, covering the greater part of the cerebrum, but in other respects the brain had no unusual appearance. The stomach was contracted and filled with a fluid, not resembling laudanum either in colour or smell. There was no inflammation present.†

In Mr. Cornish's case, coagulable lymph was effused between the dura mater, the arachnoid coat and the pia mater, and there was rather more fluid than is usual in the lateral ventricles. The stomach was natural, and the bladder contained about a pint of urine.‡

Effect on animals. Crude opium, or its watery extract, when introduced into the stomach of dogs, caused within a few hours, a weakness and paralysis of the posterior extremities, and convulsions of the muscles of the trunk and face. The pupils of the eye were not, however, more dilated than natural, and there was no moaning, but an extreme dejection. The paralysis and convulsions increased until death supervened. Similar effects were produced when

* London Med. Repertory, vol. 14, p. 426. In a case quoted by Orfila, from Lassus, the stomach is also said to have been inflamed. These however, I believe, are rare cases.

† Vol. 6, p. 414.

‡ London Med. and Phys. Journal, vol. 31, p. 193. The same state of the bladder was seen in another case. Ibid. vol. 28, p. 80.

the œsophagus was tied, except that death ensued earlier, from large doses.

When the watery extract was inserted into the cellular tissue of the thigh of a dog, paralysis of the posterior extremities, convulsions and accelerated circulation, with trembling of the head and twitches of the lower jaw occurred, and death followed in a much shorter time than in the previous series of experiments. The injection of the extract into the anus, produced the earlier symptoms of the poison, but the animals recovered.

Dissections generally presented the digestive canal in a sound state. The lungs however were usually livid and distended with blood, and the blood in the ventricles was often black and coagulated.*

Treatment. On this point, I must necessarily be brief, but a few remarks on it, can hardly ever be misplaced in a work of this nature.

The experiments of Orfila have demonstrated, that the administration of vinegar or other vegetable acids previous to the evacuation of the poison by vomiting, *will accelerate and aggravate the action of the opium;* but that when the opium has previously been expelled, water acidulated with vinegar or any other vegetable acid, will tend to diminish and correct the effects. Coffee, when prepared in the form of strong decoction or infusion, rapidly lessens the symptoms, but cannot be considered as an antidote. The results of his experiments led him to give the following directions for the treatment of a person poisoned by opium. Induce vomiting, if possible, with sulphate of copper, tartar emetic, or sulphate of zinc. And the administration of watery liquors, with the view of

* Orfila, vol. 2, p. 110 to 116. The experiments of Fontana made some forty years since, led him to the result, that the watery solution would kill animals by injecting it into the cellular tissue, or into the anus, but when the opium was dissolved in alkohol, its effects were much quicker and more violent. He hence drew the conclusion, that this difference was the effect of the alkohol, but such an opinion is evidently untenable, while the diversity of results is readily explained by the late discoveries concerning opium. See an account of Fontana's experiments in the Med. Commentaries, vol. 12, p. 113.

promoting the vomiting should be forbidden, as they dissolve the opium and promote its absorption. Bleed the patient immediately after the rejection of the poison, and repeat this if necessary. Afterwards, administer alternately water acidulated with any vegetable acid, and a strong infusion of coffee warmed. And in ten or twelve hours exhibit an enema, and let the arms and legs of the patient be well rubbed. Purgative clysters should be continued, if it be suspected that any of the opium still remains in the large intestines.*

These directions comprise, I apprehend, the most valuable part of the practice now adopted in cases of poisoning by opium, and numerous instances are on record, which either directly or indirectly strengthen them. Another circumstance which increases their value, is the fact that they are principally deduced from experiments on animals.†

The affusion of cold water on the head and over the body,‡ must also doubtless prove a valuable assistant.‖

* Orfila, vol. 2, p. 172 to 193.

† A reference to a few cases may be useful to the examiner; and of these, that related by Dr. Marcet, (Medico-Chirurg. Transactions. vol. 1, p. 77,) is one of the most instructive. The patient had swallowed *six ounces* of laudanum. Six hours after, when dissolution was apparently near, the sulphate of copper was given, and induced vomiting. He was kept incessantly on his legs, and internal stimulants were freely administered. Blisters and sinapisms were also applied to the feet. By persisting in this course, and aiding it by other judicious treatment, for which I refer to the case, the patient recovered.—See also cases of recovery in Edinburgh Med. and Surg. Journal, vol. 7, p. 305, by *Mr. M'Kechnie.* Ibid. vol. 14, p. 603, by *Dr. Kinnis.* Ibid. vol. 17, p. 226, by *Mr. Richardson.* Venesection was used in this instance with great success. Ibid. vol. 18, p. 49, two cases by *Dr. Howison.* Ibid. vol. 18, p. 343, by *Dr Kennedy.* Ibid. vol. 19, p. 247, by *Mr. Ross.* Here also venesection, after the administration of emetics, proved successful in removing the comatose symptoms. New-York Med. Repository, vol. 5, p. 124, by *Dr. Rush,* recommending venesection, and stating four cases in which it was successfully used. This was in 1801. Ibid. vol. 16, p. 10, by *Dr. Akerly.* A curious fact is mentioned by Dr. A. A lunatic stole two ounces of laudanum, which was super-saturated with carbonate of potash, and swallowed it. It produced no bad effects.—I may add in this place, that I have known most happy results from a repetition of strong enemas of assafœtida, particularly during the latter comatose stage.

‡ Successful cases in which this was a leading remedy, are related by Mr. Wray and Dr. Copeland, in the London Med. Repository. See Journal Foreign Science, vol. 3, p. 62 and 65.

‖ The mode proposed by Mr. Jukes, (of extracting the poison by a sy-

*Hyoscyamus niger.** (Black henbane.) Naturalized in the northern states and in Canada. Several cases are on record of the baneful effects of this plant. Wepfer mentions that several monks made a repast on the roots of wild endive, among which were mixed by mistake two roots of henbane. In a few hours, some experienced vertigo; others a burning of the tongue, lips and throat. Severe pains were also felt in the iliac region, and in all the joints. The intellectual faculties and organs of vision were perverted, and they gave themselves up to actions that were mad and ridiculous. They, however, recovered. In other cases, a haggard countenance, dilatation of the pupils, difficult breathings, small and intermittent pulse, loss of speech, trismus, and temporary loss of intellect, have been the principal symptoms, while the extremities have been observed cold and nearly paralyzed. A glyster prepared of a decoction of henbane, caused a numbness and loss of motion of the upper and lower extremities, propensity to sleep, and difficulty of hearing.†

Dr. Patouillat, of Toucy in France, saw nine persons poisoned with this root. Some were speechless and convulsed; others occasionally howled. In all, there was a protrusion of the eyes, contortion of the mouth, and delirium. Emetics relieved them, but their sight was for some days affected, and all objects appeared red like scarlet.‡

The vapours of this plant and of belladonna are said to have been lately used by Hufeland in nervous affections. When exposed to this, even although precautions were taken to prevent the fumes from

ringe introduced into the stomach,) also deserves attention in extreme cases. He used it successfully on himself. See New-England Journal, vol. 12, p. 181.

* Meissner and Brandes have discovered an alkaline body in this plant, which they term *hyoscyama*, and in which they conceive the poisonous properties to be concentrated. The vapour of it is very injurious to the eyes, and the most minute fragments placed on the tongue prove very deleterious. Tilloch, vol. 57, p. 308. Brande's Journal, vol. 11, p. 205.

† Orfila, vol. 2, p. 135 to 139. Foderè, vol. 4, p. 25.

‡ Phil. Transactions, vol. 40, p. 446. See also additional cases by *Dr. Stedman*, in Ibid. vol. 47, p. 194; by *Sir Hans Sloane*, Ibid. vol. 38, p. 99.

reaching the face, profuse perspiration ensued, with a sense of fulness in the head, and sometimes tremors, difficult respiration, and vertigo.*

On animals, the juice and decoction of the root produced lethargic effects, but very seldom any giddiness or convulsions. When applied to the cellular texture, death ensued sooner, and vomiting occurred in one case, but generally the comatose symptoms were all that were observed. No inflammation was noticed in the stomach; the lungs were occasionally livid, and black blood was observed in the heart.

Hyoscyamus albus. (White henbane.) The following case is an example of its effects. In April, 1792, a large quantity was carried by mistake on board the French corvette, *La Sardine*, which the sailors had gathered in one of the isles of Sapienzi in the Morea, where the vessel then was. A part of it was put into the ship's copper, and the remainder into those of some of the subaltern officers. At four o'clock they all dined. In a short time, vertigo, vomiting, convulsions, gripes and purging, were generally experienced; and when Dr. Picard, the surgeon, came on board, he observed the gunner making a thousand grimaces and contortions. By keeping up the evacuations, most of them recovered; but those in whom there were none, remained for some time in a sickly condition.†

The *Hyoscyamus aureus, physaloides* and *scopolia*, are also deemed poisonous.

PRUSSIC ACID. *(Hydrocyanic Acid.)*

This substance in its concentrated state, is one of the most energetic of poisons, and its virulence varies with its strength.

The following case is related on the authority of Hufeland, as an example of its effects. A man about to be taken up as a thief, swallowed an ounce, at 2 P.

* Monthly Journal of Medicine, vol. 1, p. 296.
† Foderè, vol. 4, p. 23.

M. He staggered a few steps, and fell. The pulse could not be felt, and there was no trace of breathing. In a few minutes, a single and violent expiration took place. The extremities were cold; the eyes half open and shining, but without any irritability. At night he was stiff. The blood on dissection had the smell of bitter almonds. The pia mater and vessels of the brain were filled with blood. The stomach was highly inflamed, and presented gangrenous spots of the size of a sixpence. The villous coat separated on the slightest pressure of the nails. The intestines were healthy—the liver natural, but filled with black blood. All the blood was collected in the veins, while the arteries were empty, and it was generally of a black-blue colour, fluid, yet thick like oil, and had a most penetrating smell of bitter almonds.*

Orfila also relates the following as communicated to him by M. Fueter. "M. B. professor of chemistry, left, from forgetfulness, a flask, containing alcohol saturated with prussic acid. The servant-girl, seduced by the agreeable smell of the liquor, swallowed a small glass of it. At the expiration of two minutes, she fell dead, as if she had been struck with apoplexy. The body was not opened."†

The inspiration of this substance when diffused in the state of gas through his laboratory, caused in Dr. Ittner, oppression and painful respiration, giddiness, vertigo, and burning heat.‡

It is not necessary at this time to enlarge on its use in medicine, but I will only observe that no caution can be too great in administering this highly powerful agent.‖

Effects on animals. Two drops of the acid pre-

* London Med. Repository, vol. 4, p 506.

† Orfila, vol. 2, p. 147.

‡ American Med. Rec. vol. 2, p. 530. See also the effects produced on Prof. Silliman, from breaking a bottle in his laboratory. Silliman's Jour. vol. 2. p. 93.

‖ The following articles deserve perusal on this point—on *the deleterious effects of the hydrocyanic acid*, by Dr. Randolph, of Philadelphia. Amer. Med. Rec. vol. 4, p. 456. Review of Granville's treatise on prussic acid Ibid. vol. 4, p. 562.

pared according to the process of Scheele, and which consequently contained considerable water, caused a bitch to stagger, fall and vomit. Eight drops induced weakness, plaintive cries, purging, falling down, tetanic stiffness, dilatation of the pupils, paralysis, insensibility, and at length sleep. "In fifteen minutes the animal rose up, passed some urine, experienced an opisthotonos, and in half an hour was recovered." Thirty or forty drops destroy dogs and cats in six, twelve or fifteen minutes after taking them, and the blood is all found in the veins, the arteries being empty, while the muscles are pale. Convulsions generally attend the administration of this poison.

Animals of various classes equally sink under its effects—a carp who was made to swallow twenty-four drops—snails, helices, leeches, crabs, lobsters, bees, ants, and grasshoppers. A cow, according to Emmert, died with all the phænomena of opisthotonos, a few seconds after injecting half a drachm into the trachea.*

M. Robert exposed animals to the aperture of a matrass, in which prussic acid had been distilled, and the air of which consequently was a mixture of the atmospheric fluid with the vapour of this acid. Birds, rabbits, cats, and dogs, all died in a short space of time—from an instant to six minutes. The liquid acid in its pure state, and also dissolved in alcohol, was equally, but not so promptly destructive. He examined a dog destroyed by it. The brain was healthy, but exhaled the odour of prussic acid. The tongue was soft, bluish, and hung out of the mouth. The mucous membrane of the trachea was injected. The lungs were of a bright red hue, and the heart was filled with very dirty deep red blood. The veins contained thick and dark coloured blood. The lungs and heart, and their contents, exhaled the odour of prussic acid.†

* Orfila, vol. 2, p. 142 to 146.

† See his experiments in the Lond. Med. Rep. vol. 3, p. 243 to 249.

These details are sufficient to illustrate the effects of this poison, and I will content myself with referring the examiner to some other sources of information on this point.*

Tests. Dr. Granville, in his treatise on the prussic acid, recommends the following : collect the blood contained in the ventricles of the heart, a portion of the contents of the stomach, and of the superior intestines, together with any certain quantity of any fluid that may be present within the cavity of the head, chest, or abdomen. Having agitated this mixture for some time in distilled water and filtered it, proceed to the following experiments. (*a*) To a small quantity of the liquid, add a few drops of a solution of caustic potash in alcohol. (*b*) To this, add a few drops of sulphate of iron, and if prussic acid be present, a cloudy and reddish precipitate, of the colour of burnt terra-siena will fall down. (*c*) Now introduce some sulphuric acid, when the colour of the precipitate will instantly change to that of a bluish-green, which, by a permanent contact with the atmospheric air, becomes gradually of a beautiful blue. Or, (*a*) treat the filtered liquor with carbonate of potash ; (*b*) add a solution of sulphate of iron with a small quantity of alum. A precipitate, as in the former method, will fall down, which, if treated by (*c*) sulphuric acid will also become blue and pulverulent. During this last experiment, carbonic acid gas is disengaged. The precipitate, which is a true Prussian blue, may also be decomposed.†

Antidotes. Where a substance acts with such tremendous vigour, it is difficult to present an antidote,

* Essay on prussic acid, by Davis and Parent. Amer. Med. Rec. vol. 2, p. 573. Experiments by Dr. *Davie*, Eclectic Repertory, vol. 10, p. 246. A few drops thrown on the eye of a cat, caused death. Annals of Philosophy, vol. 12, p. 23. It is here stated that Magendie dipped a rod into the acid prepared according to Gay Lussac's method, and brought it in contact with the tongue of an animal. Death ensued before the rod could be withdrawn. See also Gay Lussac's essay on prussic acid, in the Annals, vols. 7 and 8, and Magendie's, in Brande's Journal, vol. 4, p. 347.

† New-England Journal, vol. 10, p. 362.

which shall counteract its effects. And accordingly we know of none that deserves the name. Dr. Granville recommends brandy and water, with perhaps some liquid ammonia—and the latter in combination with diluted camphorated spirit, or oil of turpentine, as the most efficacious.*

Caustic potash, when combined with prussic acid, previous to its administration, destroys its poisonous effects, and it has hence been suggested as an antidote, but in the experiments where it was used, it failed in counteracting the effects.†

Prussic acid is also the poisonous ingredient in several vegetables, such as the

Prunus lauro-cerasus. (Cherry-laurel.)
Amygdalus communis. (Bitter almonds.)
Amygdalus persica. (The *Peach*, its kernels, leaves and flowers.)
Prunus Avium. (Black cherry, its kernels.)
Prunus Padus.‡ (*Bird cherry tree*, its bark.)

As prussic acid is characterized by an odour similar to that of bitter almonds, it has been conjectured, that all substances possessing this odour, contain prussic acid, and experiments, so far as they have advanced, somewhat confirm this opinion.

Prunus lauro cerasus. The distilled water of this plant has been proved a poison by numerous experimenters.‖ I shall very briefly notice the results obtained.

* New England Journal, vol. 10, p. 361. Mr. John Murray also recommends ammonia, as he has recovered several animals to whom large doses were given, by dropping it into their mouths. Edinburgh Phil. Journal vol. 7, p. 124.

† Orfila, vol. 2, p. 194. Edinburgh Med. and Surg. Journ. vol. 13, p. 208. American Med. Recorder, vol. 2, p. 536 to 540.

‡ Schrader, an apothecary at Berlin, was the individual who discovered that the prussic acid is contained in the aqua lauro-cerasi and the distilled water of the flowers of the peach tree, as likewise in the infusion of bitter almonds. London Med. and Phys. Journal, vol. 10, p. 95. Bergmann, also an apothecary at Berlin, discovered in 1811, that the bark of the prunus padus contained a notable quantity of it. Annals of Philosophy, vol. 5, p. 28. See also a paper by Vauquelin, on the presence of prussic acid in vegetables, from the *Annales de Chimie*. Repertory of Arts, 2d series, vol. 2, p. 461. He detected this substance in the kernels of apricots.

‖ Orfila enumerates the following: Madden, Mortimer, Browne, Langrish, Nicholls, Stenzelius, Heberden, Watson, Vater, Rattray, the Abbe Rozier, Duhamel and Fontana.

When applied to wounds in animals, it induced vomiting, convulsions, great prostration of strength, diminished sensibility, and death. Injected into the stomach and rectum, it excited a similar train of symptoms, except that in the latter the convulsions were more violent, and tetanus of the extremities was present. Its action was most rapid and intense when injected into the jugular vein.*

Several cases are recorded of its effects on the human subject. One of the earliest happened in Dublin in 1728. Martha Boyse, servant to a person who sold large quantities of this water, gave to her mother a bottle of it, and by the latter it was given to Frances Eaton, her sister. Mrs. Eaton was a shopkeeper, and thinking it a compliment to her customers, offered them some. Among others, one Mary Whaley drank of it; went to another shop, and in about a quarter of an hour, complained of a violent disorder in her stomach. She was carried home, and from that time lost her speech, and died in about an hour, without vomiting or purging, or any convulsions. Mrs. Ann Boyse was informed of this, and came immediately to her sister. She affirmed that it could not have been the cordial that caused the death, and to convince her of it, she filled out three spoonfuls and drank it, and shortly after, two more. In a few minutes she died, without a groan or convulsions.†

Foderè says, that when he was attending his studies at Turin in 1784, the chamber-maid and manservant of a noble family of that town, stole, for the purpose of regaling themselves, from their master, a bottle of distilled laurel-water, which they took for an excellent cordial. Fearful of being surprised, they hastily swallowed, one after the other, several mouthfuls of it, but they soon paid the price of their dishonesty, for they expired almost instantly in con-

* Orfila, vol. 2, p. 148 to 153. Also an analysis of the experiments of Fontana, in the Med. Commentaries, vol. 12, p. 106.

† Phil. Transactions, vol. 37, p. 84. Communicated by Dr. Madden. His experiments on animals are also contained in the same article. Dr. Mortimer's, in vol. 37, p. 163. Fontana's, in vol. 70 p. 163.

vulsions. The dead bodies were carried to the university for examination. The stomach was found highly inflamed, but the rest of the organs were in a sound state.*

It has also formed the subject of investigation in a very interesting criminal trial, whether this substance was the cause of death; and as cases of criminal poisoning by vegetable substances are very rare, I shall present a full abstract of it. The trial was that of Capt. Donellan for the murder of Sir T. Boughton.

Sir Theodosius Boughton was a young gentleman of fortune, in the county of Warwick in England, and nearly arrived at the age of twenty-one. His mother, and his brother-in-law Capt. Donellan, and his sister, (Mrs. Donellan,) resided with him. In the event of his dying before the period of his majority, the greatest part of his fortune descended to his sister, and Capt. Donellan would thus become entitled to a life estate in it.

Sir Theodosius was labouring under a slight venereal affection, for which he was attended by Mr. Powell, an apothecary at Rugby. His general health is, however, stated to have been good. On the 29th of August, 1780, Mr. Powell sent him a draught to be taken on the next morning, consisting of rhubarb and jalap, each fifteen grains; spirits of lavender, twenty drops; nutmeg water, two drachms; simple syrup, two drachms, and an ounce and a half of simple water. The bottle containing this draught was placed on a shelf in his bed-room.

Sir Theodosius returned in the afternoon of this day from fishing, in good health and spirits. In the morning, a servant awoke him at an early hour, for the purpose of obtaining some straps for a net. He arose, and went into the next room for them. Even now he appeared in perfect health. About 7 A. M. Lady Boughton got up and went into his room, as he had before desired her to give him the medicine. She

* Foderè, vol. 4, p. 27.

enquired whether he had taken it, or whether he chose that she should give it to him. He desired her to reach down the draught, which was labelled—"Purging draught for Sir T. B." and she poured it into a cup, for the purpose of his taking it. He had not, however, swallowed more than half of it, when he complained that it was so nauseous to the taste, and disagreeable to the smell, that he did not apprehend he should be able to keep it on his stomach. This remark induced Lady Boughton to smell the draught. She found it very peculiar in this respect, and observed to him, that it smelt very strongly of bitter almonds. He eat some cheese, in order to take the taste out of his mouth, and afterwards washed his mouth with some water. In about two minutes after swallowing the draught, he appeared to struggle very much, as if to keep it down, and had a rattling and guggling at his stomach. These symptoms continued about ten minutes, when he seemed to Lady Boughton to be inclined to go to sleep, and she left the room. She returned again in about five minutes, and was surprised to find him with his eyes fixed upwards, his teeth clenched, and froth running out of his mouth. He died in about half an hour afterwards, having never spoken since he took the draught.

Mr. Donellan came into the room when Sir Theodosius was dying, and inquired of Lady Boughton where the physic bottle was. She showed it to him. He immediately took and poured water into it, shook it, and then emptied its contents into the wash-hand basin. And he persisted in doing this with another bottle, although Lady Boughton remonstrated, and objected to his conduct. Mr. Powell was sent for, but arrived after the death of Sir Theodosius.

It appeared also in evidence, that Capt. Donellan had a still in his own room, and that he had used it for distilling roses. Some days after the death of Sir T. he brought this still to one of the servants to be cleaned. It was full of lime, and the lime was wet. On the other hand, it appeared on the cross examina-

tion of Lady Boughton, that Sir T. a short time before his death, had bought a quantity of arsenic, in order to poison fish, and some of this was afterwards found locked up in his closet.

Suspicions soon began to be excited as to the cause of this sudden decease, and when these reached the ears of Sir William Wheeler, the guardian of the young baronet, he wrote to Captain Donellan, informing him of the rumors that were abroad, and requesting him to have the body opened, in order to satisfy the family and the public. Donellan, in his answer, immediately consented to this, and sent for some medical gentlemen. He, however, did not explain to them the cause of his request; and as they were thus led to suppose it merely an ordinary case, they declined the performance, from the circumstance that the body was already far advanced in a state of putrefaction. It is not necessary, nor indeed does it belong to this statement, to enumerate the various devices by which Captain Donellan evidently attempted to elude the wishes of Sir William Wheeler respecting a dissection. On the eighth day after death, the body was buried, but it was taken up immediately after by the coroner, and opened. It was found swoln and distended, the face was black, the lips swoln and retracted and showing the gums, the teeth black, the tongue protruding, and the skin spotted in many parts of the body. "The orifices and small arch of the stomach, and the intestines, bore the appearance of inflammation, the heart was natural, the lungs were suffused with blood, looking red and spotted in many places, with black specks, and on the back part, the blood had settled in a deep red colour, almost approaching to purple; the diaphragm was in the same state, and in general, upon the depending surfaces of the body, the blood was settled in the like manner; the kidneys appeared black as tinder, and the liver much in the same state." There was also some blood extravasated in the thorax.

Several physicians and surgeons, (Dr. Rattray,

Dr. Ashe, Dr. Parsons, professor of anatomy at Oxford, and Mr. Wilmer,) deposed, that they had performed experiments on animals with laurel water, and found the effects very similar to the symptoms in the case of Sir Theodosius. Death succeeded in a few minutes, after having been preceded by convulsions. The appearances on dissection also agreed.

It may be mentioned in this place, that Mr. Powell prepared a draught precisely alike to that which he had sent to the baronet, with the addition of some laurel water, and Lady Boughton on being requested to smell this, stated that it resembled the one she had given to her son.

The counsel for the prisoner, in their cross examination, enquired of the medical witnesses, whether the presence of epilepsy or apoplexy would not account for the symptoms observed? To this, a negative answer was given. Dr. Parsons thought they resembled the latter most, but he was decided in attributing them to the effects of the medicine. Sir Theodosius was young, and of a thin habit, and it was hence very improbable that apoplexy should have caused his death.

They also enquired, whether the appearances observed on dissection might not be the effects of putrefaction. It was allowed that the external might, but not the internal.

On the part of the prisoner, the celebrated John Hunter was summoned as a witness. As this is probably the only time when that distinguished surgeon appeared before a court to testify on a case of poisoning, and as his examination is peculiarly interesting, I conceive that I shall do a service by quoting it entire.

Mr. John Hunter *sworn; examined by Mr. Newnham.*

Q. Have you heard the evidence that has been given by these gentlemen?

A. I have been present the whole time.

Q. Did you hear Lady Boughton's evidence?

A. I heard the whole.

Q. Did you attend to the symptoms her Ladyship described, as appearing upon Sir Theodosius Boughton, after the medicine was given him?

A. I did.

Q. Can any certain inference upon physical or chirurgical principles be drawn from those symptoms, or from the appearances externally or internally of the body, to enable you, in your judgment to decide, that the death was occasioned by poison?

A. I was in London then, a gentleman who is in court waited on me with a copy of the examination of Mr. Powell, and Lady Boughton, and an account of the dissection, and the physical gentlemen's opinion upon that dissection.

Q. I don't wish to go into that, I put my question in a general way?

A. The whole appearances upon the dissection, explain nothing but putrefaction.

Q. You have been long in the habit of dissecting human subjects? I presume you have dissected more than any man in Europe?

A. I have dissected some thousands during these thirty-three years.

Q. Are those appearances you have heard described, such in your judgment, as are the result of putrefaction in dead subjects?

A. Entirely.

Q. Are the symptoms that appeared after the medicine was given, such as necessarily conclude that the person had taken poison?

A. Certainly not.

Q. If an apoplexy had come on, would not the symptoms have been nearly or somewhat similar?

A. Very much the same.

Q. Have you ever known or heard of a young subject dying of an apoplectic or epileptic fit?

A. Certainly; but with regard to the apoplexy not so frequent, young subjects will perhaps die more fre-

quently of epilepsies than old ones; children are dying every day from teething, which is a species of epilepsy arising from an irritation.

Q. Did you ever in your practice, know an instance of laurel water being given to a human subject?

A. No, never.

Q. Is any certain analogy to be drawn from the effects of any given species of poison upon an animal of the brute creation, to that it may have upon a human subject?

A. As far as my experience goes, which is not a very confined one, because I have poisoned some thousands of animals, they are very nearly the same, opium for instance will poison a dog similar to a man, arsenic will have very near the same effect upon a dog, as it would have, I take for granted, upon a man; I know something of the effects of them, and I believe their operations will be nearly similar.

Q. Are there not many things which will kill animals almost instantaneously, that will have no detrimental or noxious effect upon the human subject; spirits, for instance occur to me?

A. I apprehend a great deal depends upon the mode of experiment; no man is fit to make one, but those who have made many, and paid considerable attention to all the circumstances that relate to experiments. It is a common experiment which I believe seldom fails, and is in the mouth of every body, that a little brandy will kill a cat; I have made the experiment, and have killed several cats, but it is a false experiment; in all those cases where it kills the cat, it kills the cat by getting into her lungs, not into her stomach, because if you convey the same quantity of brandy, or three times as much into the stomach, in such a way as the lungs shall not be affected, the cat will not die; now in those experiments that are made by forcing an animal to drink, there are two operations going on, one is a refusing the liquor, by the animal, its kicking and working with its throat, to

refuse it, the other is a forcing the liquor upon the animal, and there are very few operations of that kind, but some of the liquor goes into the lungs. I have known it from experience.

Q. If you had been called upon to dissect a body, suspected to have died of poison, should you or not have thought it necessary to have pursued your search through the guts ?

A. Certainly.

Q. Do you not apprehend that you would have been more likely to receive information from thence than any other part of the frame ?

A. That is the track of the poison, and I certainly should have followed that track through.

Q. You have heard of the froth issuing from Sir Theodosius' mouth, a minute or two before he died, is that peculiar to a man dying of poison, or is it not very common in many other complaints ?

A. I fancy it is a general effect, of people dying in what you may call health, in an apoplexy or epilepsy, in all sudden deaths, where a person was a moment before that in perfect health.

Q. Have you ever had an opportunity of seeing such appearances upon such subjects ?

A. Hundreds of times.

Q. Should you consider yourself bound, by such an appearance, to impute the death of the subject to poison ?

A. No, certainly not; I should rather suspect an apoplexy, and I wish in this case, the head had been opened to remove all doubts.

Q. If the head had been opened, do you apprehend all doubts would have been removed ?

A. It would have been still farther removed, because, although the body was putrid so that one could not tell whether it was a recent inflammation, yet an apoplexy arises from an extravasation of blood in the brain, which would have laid in a coagulum. I apprehend although the body was putrid, that would have been much more visible than the effect any poison could have had upon the stomach or intestines.

Q. Then in your judgment upon the appearances the gentlemen have described, no inference can be drawn from thence that Sir Theodosius Boughton died of poison?

A. Certainly not; it does not give the least suspicion.

Cross-examined by Mr. Howorth.

Q. Having heard the account to-day that Sir Theodosius Boughton, apparently in perfect health, had swallowed a draught which produced the symptoms described, I ask you whether any reasonable man can entertain a doubt that that draught whatever it was, produced those appearances?

A. I don't know well what answer to make to that question.

Q. Having heard the account given of the health of this young gentleman, on the morning previous to taking the draught, and the symptoms that were produced immediately upon taking the draught, I ask your opinion as a man of judgment, whether you don't think that draught was the occasion of his death?

A. With regard to his being in health, that explains nothing; we frequently, and indeed generally, see the healthiest people dying suddenly, therefore I shall lay little stress upon that; as to the circumstances of the draught, I own they are suspicious, every man is as good a judge as I am.

Court. You are to give your opinion upon the symptoms only, not upon any other evidence given.

Mr. Howorth. Upon the symptoms immediately produced, after the swallowing of that draught, I ask whether in your judgment and opinion, that draught did not occasion his death? A. I can only say, that it is a circumstance in favor of such an opinion.

Court. That the draught was the occasion of his death? A. No; because the symptoms afterwards were those of a man dying, who was before in perfect health; a man dying of an epilepsy or apoplexy, the symptoms would give one those general ideas.

Court. It is the general idea you are asked about now, from the symptoms that appeared upon Sir Theodosius Boughton, immediately after he took the draught, followed by his death so very soon after; whether upon that part of the case, you are of opinion that the draught was the occasion of his death?

A. If I knew the draught was poison, I should say, most probably, that the symptoms arose from that; but when I don't know that that draught was poison, when I consider that a number of other things might occasion his death, I cannot answer positively to it.

Court. You recollect the circumstance that was mentioned of a violent heaving in the stomach? A. All that is the effect of the voluntary action being lost, and nothing going on but the involuntary.

Mr. Howorth. Then you decline giving any opinion upon the subject? A. I don't form any opinion to myself; I cannot form an opinion because I can conceive if he had taken a draught of poison, it arose from that; I can conceive it might arise from other causes.

Q. If you are at all acquainted with the effects and operations of distilled laurel water, whether the having swallowed a draught of that, would not have produced the symptoms described? A. I should suppose it would; I can only say this of the experiments I have made of laurel water upon animals, it has not been near so quick; I have injected laurel water directly into the blood of dogs, and they have not died; I have thrown laurel water, with a precaution, into the stomach, and it never produced so quick an effect with me, as described by those gentlemen.

Q. But you admit that laurel water would have produced symptoms such as have been described?

A. I can conceive it might.

Mr. Newnham. Would not an apoplexy or epilepsy, if it had seized Sir Theodosius Boughton at this time, though he had taken no physic at all, have produced similar symptoms too? A. Certainly.

Q. Where a father has died of apoplexy, is that not understood, in some measure, to be constitutional?

A. There is no disease whatever, that becomes constitutional, but what can be given to a child. There is no disease which is acquired, that can be given to a child; but whatever is constitutional in the father, the father has a power of giving that to the children: by which means it becomes what is called hereditary; there is no such thing as an hereditary disease; but there is an hereditary disposition for a disease.

Mr. Howorth. Do you call apoplexy constitutional? A. We see most diseases are constitutional; the small pox is constitutional, though it requires an immediate cause to produce the effects. The venereal disease is hereditary. I conceive apoplexy as much constitutional as any disease whatever.

Q. Is apoplexy likely to attack a thin young man who had been in a course of taking cooling medicines before? A. Not so likely, surely, as another man; but I have, in my account of dissections, two young women dying of apoplexies.

Q. But in such an habit of body, particularly attended with the circumstance of having taken cooling medicines, it was very unlikely to happen? A. I do not know the nature of medicines so well as to know that it would hinder an apoplexy from taking effect.

Court. Give me your opinion in the best manner you can, one way or the other, whether upon the whole of the symptoms described, the death proceeded from that medicine, or any other cause? A. I do not mean to equivocate, but when I tell the sentiments of my own mind, what I feel at the time, I can give nothing decisive.

The judge, (the Hon. Francis Buller) in summing up the evidence, after stating that four medical witnesses were decided in attributing the death to the effects of laurel water, made the following comments on the testimony of Mr. Hunter: "For the prisoner you have had one gentleman called, who is likewise of the faculty, and a very able man. I can hardly

say what his opinion is, for he does not seem to have formed any opinion at all of the matter. He, at first, said he could not form an opinion whether the death was or was not occasioned by the poison, because he could conceive that it might be ascribed to other causes. I wished very much to have got a direct answer from Mr. Hunter, if I could, what, upon the whole, was the result of his attention and application to the subject, and what was his present opinion, but he says he can say nothing decisive. So that, upon this point, if you are to determine upon the evidence of the gentlemen who are skilled in the faculty only, you have the *very positive* opinion, of four or five gentlemen of the faculty, that the deceased died of poison. On the other side, you have what I really cannot myself call more than the *doubt* of another; for it is agreed by Mr. Hunter, that the laurel water would produce the symptoms which are described. He says an epilepsy or apoplexy would produce the same symptoms; but as to an apoplexy, it is not likely to attack so young and so thin a man as Sir Theodosius was; and as to an epilepsy, the other witnesses tell you, they don't think the symptoms which have been spoken of, do show that Sir Theodosius had any epilepsy at the time."

The jury retired for about an hour, and then brought in a verdict of guilty, and Capt. Donellan was executed in a few days thereafter.*

It was, and still is, a prevailing opinion with many, that Sir Theodosius Boughton was not poisoned, and that Captain Donellan was innocent. Dr. Male notices this case, as "a melancholy and striking instance of the unhappy effects of popular prejudice, and the fatal consequences of medical ignorance."† Mr. Phillips in his "Theory of presumptive proof,"

* This abstract is taken from a folio pamphlet, entitled "The trial of John Donellan for the wilful murder of Sir Theodosius Edward Allesley Boughton, bart. at the assize at Warwick, on Friday, March 30, 1781, before the Hon. Francis Buller, Esq. one of the justices of his majesty's court of king's bench. The second edition. Taken in short-hand by Joseph Gurney." London, 1781. † Male, p. 86.

adduces it as an instance where a man was unwarrantably condemned on circumstantial evidence.*

I cannot agree with either of these gentlemen, although I will readily allow that too much dependence was placed on the appearances found on dissection. Putrefaction was evidently too far advanced to render them a certain ground of testimony.

As a medical man, it might be enquired of Dr. Male, whether the symptoms preceding this death have not been most strikingly and astonishingly verified, as *probably* originating from laurel water, by the subsequent investigations of chemists and physicians. Mr. Hunter, in his testimony, says, that he had never known laurel water to act so rapidly as the other medical witnesses described. He had injected it into the veins and into the stomach of animals, *but it never produced so quick an effect.* Who, I would ask Dr. Male, have subsequent experiments proved to be right on this point? Mr. Hunter, or the other witnesses. Let the facts I have adduced in previous pages answer this question.

Again, Mr. Phillips, and others, object greatly, that the whole proof as to its being laurel water, rested upon the comparison of the smell. Now I conceive this to be a very satisfactory circumstance. The medicine administered by Mr. Powell did not contain laurel water—while few, very few indeed, of the fluids in common use, possess a smell at all resembling that of bitter almonds. This property is peculiar—confined to a certain number of vegetable products, several of which, even at that day, were known to be deleterious.

Capt. D. had a still in his own room—there were laurels and bays in the garden, (see Amos' testimony.) This is a sufficient answer to Mr. Phillips' question, *where did the prisoner procure it?* Certainly, if there was an intention on the part of Cap-

* Appendix to his treatise on the law of evidence, p. 36.

tain Donellan, to use the laurel water for the purpose of poisoning, we have shown *how he could obtain it.**

I have made these few remarks on this case, not for the purpose of asserting positively that Sir Theodosius Boughton was poisoned, but to state a few circumstances, which tend to shew that this was not an instance of *judicial murder*, for such I apprehend, it must be considered by the critics on it.

"Dr. Male," says Dr. Smith, "states in so many words, *that it was neither proved that the deceased was poisoned, nor that any poison had existed.* Equally dissatisfied, perhaps with the manner, in which the professional testimony was given, the evidence of the eminent individual, upon whom he founds this opinion, *has not led me to draw the same conclusion.*"†

The *oil of laurel* also acts as a virulent poison, and in a similar manner to the *distilled water.* The *watery extract*, however, according to Orfila, is very feeble, and comparatively innoxious in its operation.

Amygdalus communis. (Bitter almonds.) These, when pounded and taken in sufficient quantity, prove highly deleterious, as has been proved by numerous experimenters.‡

The essential oil of bitter almonds acts violently. One drop applied to the tongue of a cat, instantly excited convulsions, to which loss of motion and insensibility succeeded—the respiration became hurried, and death followed at the end of five minutes. So also when two drops were injected into the rectum. While performing these experiments, Mr. Brodie touched his tongue with a probe that had been dipped into the oil. He instantly experienced an uneasy sensation in the epigastric region, and a weakness of

* The fact of Captain Donellan's having a still, is cautiously omitted in Mr. Phillips' statement of the case. Nor is this a solitary instance of omission; and in proof of this, I request any gentleman to compare the abstract I have given, (and which is taken almost verbatim from the trial) with that presented by Mr. Phillips. His comments on the medical testimony, are evidently founded on imperfect information concerning the subject in dispute.

† Smith's Forensic Medicine, p. 171.

‡ Orfila, vol. 2. p. 156.

the limbs: The application of the oil to the cellular texture, was equally, but not instantaneously, destructive.*

Two cases are said to have occurred at Montpelier, of children poisoned by the use of bitter almonds. In one, the person had eaten them after they had been heated in a copper vessel; and in the other, the child had been made to drink the milk, as a remedy against worms.†

Virey has suggested the sulphate of iron as an antidote of this substance, in consequence of restoring a cow by it, who was nearly killed by the essential oil.‡

Amygdalus persica. The kernels of the peach are very often distilled for the purpose of impregnating *eau de noyau*, and if too strongly charged with the oil, it must prove noxious. The late Duke Charles of Lorraine nearly lost his life by swallowing a small quantity of this liquor,§ and fatal cases are said to have lately occured in England from the same cause.‖

Lactuca virosa. (Strong-scented lettuce.) The extract of this plant in large doses, produces effects similar to those of opium, but a longer period is required to develope them. It acts with more rapidity when applied to the cellular texture, or injected into the veins.

Solanum dulcamara. (Woody nightshade.) A native of the United States. It has been supposed that this, and other species of the same genus, (*Solanum nigrum, villosum, fuscatum,* &c.) were poisonous, but the experiments of Dunal and Orfila evi-

* Brodie's Experiments on Vegetable Poisons, from the Phil. Trans. in Eclectic Repertory, vol. 2, p. 272, 279.

† London Med. and Phys. Journal, vol. 11, p. 92.

‡ London Med. Repository, vol. 8, p. 178. Vogel and Robiquet have lately examined the nature of the volatile oil of bitter almonds with considerable minuteness. When exposed to the air for a few minutes, it becomes a crystalline mass, and loses its odour. The volatile part proved excessively poisonous, while the crystallizable matter was found by Robiquet to be quite inert. Brande's Journal, vol. 13, p. 404, and vol. 15, p. 155. Vogel's analysis of bitter almonds is given in Annals, vol. 11, p. 426.

§ London Med. Repository, vol. 4, p. 15.

‖ An oil is also obtained by distilling the leaves. See Brugnatelli's Experiments, in Annals, vol. 7, p. 325.

dently prove that they possess very moderate narcotic powers.*

Taxus baccata. (The yew.) Great diversity of opinion has existed concerning the properties of this plant. Orfila, however, deems it a narcotic.

Dr. Percival relates, that the fresh leaves were administered to three children, of five, four, and three years of age, near Manchester, for worms. Yawning and listlessness soon succeeded, and the oldest vomited a little, and complained of pain in the abdomen; but the others expressed no sign of pain. They all died within a few hours of each other.†

Actæa spicata. (Herb Christopher. Bane-berries.) A native of the United States. The berries of this plant are noxious, according to the testimony of Linnæus, Colden, and Le Monnier. It is poisonous to cattle, but sheep and goats eat it.

Physalis somnifera, Azalea pontica, and *Peganum harmela,* are deemed narcotics.

Ervum ervilia. (Lentil.) Food into which the seed of this plant enters, is said to produce weakness and paralysis of the lower extremities.

The seeds of the *Lathyrus cicera,* have similar properties.‡

Paris quadrifolia. (Herb Paris,) occasions vomitings and spasms. The root of *paris polyphylla* is also said to be highly poisonous.‖

I venture to add to these the following:

Gelseminum nitidum of Michaux. (Yellow jessamine.) The flowers, root, &c. of this shrub are narcotic, and the effluvia from the former are said some-

* Orfila, vol. 2, p. 164. Desfosses has, however, lately announced the presence of a narcotic principle in the *Solanum nigrum,* and which he styles *Solanine.* It produces great somnolency, the evacuation of much glairy and mucous matter from the intestines, and sickness at the stomach. Chapman's Journal, vol. 4, p. 216, and vol. 5, p. 96.

† Med. Commentaries, vol. 6, p. 33. It is also mentioned, that a drove of cattle (twelve in number) were poisoned in December, 1814, in Montgomeryshire, (Wales,) from eating the branches of this tree. Edinburgh Annual Register, vol. 7, p. 162. Two cases of death from its leaves and berries, are mentioned by Metzger, p. 397.

‡ Orfila, vol. 2, p. 166.

‖ Edin. Phil. Journal, vol. 1, p. 380.

times to induce stupor.* In the newspapers of May, 1823, it is mentioned, that a child of Mr. James Broughton, of N. Carolina aged two years, died in the space of half an hour, after eating the flowers of this plant. Blindness ensued within a minute or two after swallowing them.

The general treatment recommended in cases of poisoning with opium, is proper in all cases which we have not particularly noticed.

3. Narcotico-acrid poisons.

This title is evidently an incorrect one, since some of the substances belonging to the class, do not excite any rubefaction on the texture to which they are applied, while the narcotic nature of others is extremely doubtful. We adopt it however, for reasons already assigned.

Atropa belladonna. (Deadly night shade.) The berries of this plant are highly noxious. A detachment of several hundred French soldiers, having halted at a short distance from Pirna, near Dresden, were allured by the inviting appearances of the berries of the atropa, which grew in abundance in the neighbourhood. They accordingly eat freely of them, and one hundred and eighty men were thus poisoned, many of whom died before professional assistance could be rendered, and the rest were long in recovering. The following were the symptoms as related by M. Gaultier de Claubry, the medical officer in attendance. Dilatation and immobility of the pupils—total insensibility of the eye to the presence of external objects, or very confused and indistinct vision—the conjunctiva turged with purple coloured blood—prominence of the eye, which in some, appeared dull and heavy, in others, bright and furious—great dryness of the lips, tongue, palate and throat—deglutition difficult, in some cases nearly impossible—nausea, not followed by vomiting—sense of weakness,

* Elliot's Botany of South Carolina and Georgia, vol. 1, p. 312.

lypothymia, syncope—inability to stand upright—bending forward of the trunk of the body—continual movement of the hands and fingers—lively delirium, accompanied with a silly laugh—aphonia or inarticulate sounds uttered with difficulty—ineffectual inclination to intestinal evacuation—very gradual return to health and reason, without any recollection of the preceding state.*

Several cases are also recorded by Orfila and other authors, where death followed from eating the berries, but the above is sufficient to illustrate the ordinary effects. In one instance where death ensued, the stomach was found ulcerated.†

It appears from a case related by Ray, that even the external application of the fresh leaf to the broken skin, is not unattended with danger.‡ The dilatation of the pupil of the eye from the application of this substance, is well known, and has been extensively applied in modern surgery.

The watery extract of belladonna, when administered to animals, produced vomiting, dilatation of the pupils, delirium, and in general, the same course of symptoms as in man. The stomach was sometimes ulcerated or red, and at other times sound. The lungs and heart occasionally livid.‖

* Orfila, vol. 2, p. 201. New-England Journal, vol. 4, p. 92.

† Orfila, vol. 2, p. 201. Foderè, vol. 4, p. 39. Sage saw fourteen children who had eaten of the berries. They could not swallow, and the pupils were immovable. They became drunk and furious, leaping and running. The one who had taken most, suffered under spasmodic twitchings, and discharged blood by the nose and anus, and vomited bloody and purulent matter. On recovering the power of deglutition, it was found that the whole roof of his mouth, his tonsils, and part of his tongue, were covered with aphthæ. They all survived, but on going to school four days thereafter, some saw red, others not at all, and none were able to articulate a sound. Of this they gradually recovered. Edin. Med. and Surg. Journal, vol. 9, p. 380.

‡ London Med. and Phys. Journal, vol. 12, p. 134.

‖ A vegetable alkali has been discovered in this plant by Brandes, which he terms *Atropia*. The vapour of it was so injurious, producing violent headache, pain in the back, giddiness and nausea, that he was obliged to discontinue his experiments. On tasting a small quantity of the sulphate of atropia, violent headache, shaking of the limbs, oppression and difficult circulation were induced, and M. Brandes found even the vapour of the different salts to produce giddiness. Annals of Philosophy, new series, vol. 1, p. 270. There are also experiments of Vauquelin on that part of the juice of belladonna which is soluble in alcohol, quoted in the London Med. and Phys. Journal, vol. 28, p. 209, from the Annales de Chimie.

Datura stramonium. (Thorn-apple. Jamestown weed.) Its native country doubtful, but naturalized in every part of the United States. (Bigelow.) This plant has extended itself rapidly over various parts of our country, and is certainly one of the most offensive.* There are numerous cases on record of the poisonous effects of the leaves and seeds of it.

Dr. Barton states, that in 1765, when some of the British troops under Sir John St. Clair were stationed in the vicinity of Elizabethtown, (New-Jersey,) three of the soldiers collected a quantity of the plant, (which they mistook for lamb's-quarters, *Chenopodium album,)* and dressed and ate it. One of them became furious, and ran about like a madman. The second was seized with genuine tetanus, and died.†

Dr. Rush saw a child between three and four years old, who had swallowed some of the seeds. A violent fever, delirium, tremors in the limbs, and a general eruption on the skin, were present, accompanied with considerable swelling, itching, and inflammation. Repeated emetics and purgatives, however, alleviated the disease, and brought away some of the seeds. Dilatation of the pupils and blindness still remained, but were obviated by a continuance of the previous remedies, and she recovered her health.‡

In the Transactions of the College of Physicians of Philadelphia, Dr. Moses Bartram relates, that he was called to a child suddenly seized with idiocy, without fever. The pulse was natural—tongue clear, and no internal function disturbed, except those of the brain. The child appeared very happy—talking, laughing, and in constant motion, yet so weak that it could not stand or walk without tottering. He ex-

* Dr. Barton remarks, that it grows in great abundance about Vincennes, and was introduced there about the year 1785. "The plant," he adds, "is cut down by legal order, for the inhabitants assert that they were never affected with remitting fevers until the datura was introduced among them. The effluvia arising from the leaves, stem and flowers, are supposed to have given origin to the disease." Barton's Med. and Phys. Journal, vol. 1, p. 145. This is evidently laying too much on the plant, but its effluvia is certainly noxious.

† Barton's Med. and Phys. Journal, vol. 1, p. 146.

‡ Trans. Amer. Phil. Society, vol. 1, p. 384.

hibited an emetic, and the seeds of the thorn-apple were rejected, after which the child recovered.*

Orfila enumerates the following list of symptoms as produced by this plant: "Intoxication, delirium, loss of sense, drowsiness, a sort of madness and fury —loss of memory, sometimes transitory, and sometimes permanent—convulsions, paralysis of the limbs, cold sweats, and excessive thirst and tremblings."

The stramonium was some years since used to a considerable extent in asthma, and there is reason to believe that in some cases it proved deleterious.†

The stomach of animals poisoned with the watery extract, by introduction into that organ, was found inflamed, and blood was extravasated between the mucous coat and the one subjacent to it. The lungs were of a deep red, and distended with black and fluid blood.‡

The *Datura metel, ferox* and *tatula*, are equally poisonous. The seeds of the D. metel are used in Asia for their soporific and intoxicating qualities, and are made the instrument of unbounded libertinism.‖

Nicotiana tabacum. (Tobacco.) It is not necessary to multiply cases proving the poisonous nature of this substance when taken *internally.* The death of Santeuil, a French poet, was caused by an inconsiderate

* Other cases are related by *Dr. Fowler*, (Med Commentaries, vol. 5, p. 161.) Here the face, eyes, and abdomen were swelled. The other symptoms were, however, similar to those mentioned in the text. By *Dr. Thomas Young*, (Edinburgh Med. and Surg. Journal, vol. 15, p. 154.) By *M. Sarlandiere*, (Journal Foreign Science, vol. 1, p. 463.) By *Dr. Brown*, (New-York Med. Repository, vol. 5, p. 36.) A scarlet efflorescence was here present, and the pupils were dilated. Two cases by *Dr. De Witt*, (Ibid. vol 2, p. 27.) In one instance the poison produced pain, and during recovery, there were numerous vesications on the skin.—And also by *Orfila*, from various authors. A remarkable case by *Orfila* himself, is given in the London Med. Repository, vol. 13, p. 259, where it produced most of the symptoms of poisoning, but finally was the means of curing an intense and long-continued headache. A very interesting historical account of this plant by Mr Royston, is contained in the London Med. and Phys. Journal, vol. 25 and 26.

† See on this point Dr. Bree's Letter on Stramonium, New-England Journal, vol. 1, p. 411.

‡ Brandes has also discovered an alkaline principle in this plant, styled *Datura.* Brandes' Journal, vol. 11, p. 204.

‖ Edinburgh Med. and Surg. Journal, vol. 7, p. 97. See also Royston's paper already quoted.

person emptying the contents of a snuff-box into his wine, which as soon as he had swallowed, excited violent vomiting and excessive pain, and he died in fourteen hours.* So also when the infusion, or the smoke is administered in large quantities, as by a glyster; convulsions, sickness, and vomiting supervene, and death often is the result.†

Externally, the effects are no less striking. A man and his wife fomented their bodies with a watery infusion of tobacco, in order to remove the itch. Giddiness, headach, retching and vomiting, with diarrhœa soon supervened. Thirst accompanied these, as also spasms, and the debility and oppression were great. They were however gradually relieved by judicious treatment.‡ A liniment, prepared with the powder of tobacco and butter, applied to the heads of children, labouring under tinea, caused vertigoes, violent vomitings and faintings, extreme perspiration and a staggering walk.§

Several experimenters have examined the effects of tobacco on animals. Fontana found that the insertion of the oil into wounds, induced temporary paralysis, but not death.‖ Brodie used both the infusion and the oil. The former, when injected into the rectum of an animal, produced faintness, and early insensibility and death. It stopped the circulation of the heart, and caused syncope. The latter excited violent convulsions, frequent respiration, and death, occasioning this termination by destroying the functions of the brain.¶

The experiments of Orfila with snuff, produced results generally similar to those we have now related,

* Orfila's Directions, p. 107.

† See some remarks on this point, in the Edin. Med. and Surg. Journal, vol. 9, p. 159. A case where the smoking of tobacco produced most of the symptoms of apoplexy, as stertor, insensibility of the pupil, deep livid countenance, and spasmodic contraction, is given in the same work, vol. 12, p. 11.

‡ Med. Commentaries, vol. 11, p. 327.

§ Orfila, vol. 2, p. 214.

‖ Med. Commentaries, vol. 12, p. 110. Phil. Trans. vol. 70, p. 163.

¶ Eclectic Repertory, vol. 2, p. 274.

and they also show, that the extract of the *nicotiana rustica* acts in the same manner as tobacco, but is less active.*

Digitalis purpurea. (Purple foxglove.) Dr. William Henry was called in October, 1809, to visit a female, an out patient of the Manchester Infirmary, and labouring under dropsy, who had taken an overdose of the decoction of foxglove. It was prepared by boiling two handfuls of the leaves in a quart of water, and then pressing the mass, so as to expel the whole of the liquor. Of this at 7 A. M. she drank two teacups full, amounting in the whole, to not less than ten ounce measures. Before eight, she began to be sick and vomited parts of the contents of her stomach. Enough, however, was retained to excite violent vomiting and retching throughout the whole of that and the following day, during which, every thing that was taken, was instantly rejected. In the intervals of sickness, she was excessively faint, and her skin was covered with a cold sweat. The tongue and lips swelled, and there was a constant flow of viscid saliva from the mouth. Very little urine was voided on the day she took the digitalis, and on the two following days the action of the kidnies was entirely suspended. When Dr. Henry saw her, which was forty-eight hours after she had taken the poison, the tongue was white, the ptyalism continued, though in a less degree, and the breath was fœtid. The pulse was low, irregular (not exceeding forty,) and after every third or fourth pulsation, an intermission occurred for some seconds. She complained also of general pains in the limbs, and cramps in the legs. By the use of effervescing draughts, and æther with ammonia, she gradually recovered her imperfect health. Dr. Henry remarks, that she had not taken

* Vauquelin has analysed a variety of tobacco, the *N. latifolia*, and found it to consist of an acrid principle, on which its properties depend. Albumen, supermalate of lime, acetic acid, nitrate and muriate of potash, muriate of ammonia, and a red matter, soluble in alkohol and in water, which swells and is charred by heat. Edinburgh Med. and Surg. Jour. vol. 6, p. 379.

any mercury, and that the ptyalism was entirely the effect of the digitalis.*

A man labouring under asthma, imprudently took an ounce of the tincture of digitalis. He immediately fell asleep, and slept for three hours and a half. After this, on awakening, he vomited, and likewise had a motion. He then again slept quietly. A strong emetic was now given, which operated well, and he continued tranquil and his pulse regular. After two or three hours, however, his pulse began to intermit. Strong punch was given in divided doses, and also carbonate of ammonia. This supported the system, though the pulse was at one period as low as thirty-six in a minute. The intermission lasted for about twelve hours, and *the asthma was cured.*†

When administered to animals in the form of powder, or extract, or infusion of the leaves, it excites anxiety, melancholy, smallness and slowness of pulse, involuntary stools, and convulsions—death closes the train of symptoms.

Conium maculatum. (Hemlock.) Raving madness and epileptic fits occurred to Mr. Ray, in the case of a woman who had eaten the roots of this plant.‡ Vertigo, convulsions, coma and death were the result to two soldiers at Waltham Abbey, in Essex, who had boiled it with their bacon for dinner.‖

Some soldiers partook of broth into which hemlock had been put. All of them were shortly after seized with pains in the head and throat, and felt as if drunk; but the one who had eaten the most, had lain down and gone to sleep. When first noticed, he was

* Edin. Med. and Surg. Journal, vol. 7, p. 148. This symptom has been noticed by other practitioners. Dr. Barton mentions having seen it produced in a child from ordinary doses. Barton's Med. and Phys. Journal. vol. 1, part 1, p. 80. Another case is related in Ibid. vol. 1, part 2, p. 48. Dr. Barton quotes the following remark from Dr. Withering. "I am doubtful whether it does not sometimes excite a copious flow of saliva."

† Case by Dr. Fogo in Edin. Med. and Surg. Journal, vol. 18, p. 345. See also a case quoted from Dr. Beddoes in Orfila, vol. 2, p. 228. Some useful cautions as to the use of digitalis are given in the Medico-Chirurg. Rev. vol. 1, p, 510, Amer. Edit.

‡ Phil. Transactions, vol. 19. p. 634.

‖ Ibid. vol. 43, p. 18. Case by Dr. Watson.

insensible, respiring with great difficulty—his pulse small and slow, even to thirty pulsations in the minute; the extremities were cold, and the face bluish, and distended with blood. An emetic was given without effect. He complained of being cold, but shortly after, lost again the use of speech and sense, and died in three hours after taking the poison. On dissection, there were some red spots seen round the pylorus; the intestines were healthy, but all the vessels of the brain were gorged with blood, and on opening the cranium, there flowed out blood sufficient to fill twice an ordinary chamber-pot.*

Convulsions, furious delirium, and swellings of the face, appear thus to be among the leading symptoms from the use of this poison.

The juice, and the extract when properly prepared, produce similar effects on animals. Orfila has, however, shown that the extract usually sold in the shops is inefficient and weak.†

Cicuta virosa, or *aquatica*. (Water hemlock.) This is a more violent poison than the preceding.

The following train of symptoms has been noticed —dazzling—obscurity of the sight—vertigo—headach, often acute and excruciating—a vacillating walk —anxiety of the præcordia—cardialgia—dryness of the throat—ardent thirst—eructatio—vomiting of greenish matter—frequent and interrupted respiration —tetanic contractions of the jaws, sometimes followed by lethargy, with coldness of the extremites; at other times with a furious delirium, or attacks resembling epilepsy. In one or two cases, a swelling of the face has been noticed. In a case where death followed, hiccup and fruitless efforts to vomit were present, with tetanic convulsions. The abdomen and face swelled after death, and there flowed a quantity of green froth from the mouth.‡

* Case by *M. Haaf*, quoted by Orfila, vol. 2, p. 242.

† A drachm of the extract prepared by himself was sufficient to poison a dog, whereas an ounce, and even ten drachms from several of the shops in Paris, produced no effect whatever. Quart. Jour. For. Med. and Surg. vol. 1, p. 104.

‡ Orfila, vol. 2, p. 248.

The experiments of Wepfer prove how deadly this plant is to animals, and Linnæus, in his Tour to Lapland, has illustrated it in an impressive manner. At Tornea, hundreds of cattle were annually destroyed in the spring, without any assignable cause. The poison was said to be of so pestilential a nature, that though the animals were flayed before they were cold, yet wherever their blood came in contact with the human body, it caused gangrenous spots and sores. Some indeed had lost their lives in this way. On examining the meadow into which they were first turned out to grass, he found in it a bog or marsh, in which the *Cicuta aquatica* grew in great abundance, and had evidently been plentifully cropped by the cattle in feeding.*

Cicuta maculata. (Snake-weed. Amer. hemlock.) A native of this country. We have, unfortunately, several cases on record of death produced by the root of this plant,† and from an examination of these, the following appear as the effects :—Vomiting—pain in the bowels—tenesmus, and occasionally purging—convulsions—dilatation of the pupils—feeble pulse, and frothing at the mouth and nose, mixed with blood. When not convulsed, the patients lay in a deep sleep ; the countenance is pale, and the extremities are cold. Several observers have noticed an astonishing mobility of the eyeballs and eyelashes, although the pupils are firmly and widely dilated. Death follows rapidly, and particularly in children—in two cases, within an hour after eating it.

* Linnæus' Tour in Lapland, *London edit.* vol. 1, p. 245. See also vol. 2, p. 136, 212. Cows eat it early in the spring, when its growth has just commenced, but as the summer advances, its scent becomes stronger, and warns them to avoid it. It is remarkable, however, that goats devour it with impunity. London Med. and Phys. Journal, vol. 12, p. 368.

† New-York Med. Repository, vol. 17, p. 303, two cases by *Dr. Ely*, of Dutchess county, in this state. New-England Journal, vol. 7, p. 219, case by *Dr. Hazeltine*, of Massachusetts. Ibid. vol. 3, p. 334, by *Dr. Stockbridge*. Dr. Muhlenberg states in a letter, that it had killed several at Harmony, (Pennsylvania,) who had eaten it instead of angelica. Med. Repository *ut antea*. This is also probably the plant that is described by Dr. Greenway of Virginia, under the name of *Cicuta venenosa*, in the Trans. Amer. Phil. Soc. vol. 3, p. 234. See also Bigelow's Med. Botany, vol. 1, p. 129.

One dissection has been made by Dr. Hazeltine. The limbs were more flexible than is usual. The stomach was inflated and contained about three gills of a mucous, greenish fluid, on the surface of which was seen a part of the masticated root. There were no appearances of inflammation.

Brucea antidysenterica. (False angustura bark.) This substance resembles the real angustura, and this fact indeed was noticed, shortly after the discovery of the plant by Mr. Bruce ;* but it was not until a few years since, that its deleterious nature was discovered. A patient under the care of Dr. Rambach, at Hamburgh, experienced poisonous effects from the use of a decoction ; and death also resulted from it in Hungary and Berne. This led to an examination, and it was ascertained that two species are known in commerce—the genuine, called West Indian, and the spurious East Indian angustura, (brucea.) Several experiments on animals confirmed its poisonous nature. The Austrian government was so impressed with the danger to be apprehended, that it ordered all the angustura bark in the empire, genuine and spurious, to be burnt, and interdicted its future importation. Its sale was also prohibited in Denmark ; and in Russia and Wirtemberg, the characters distinguishing each were published by authority.† Some of these may be briefly enumerated.

The taste of the genuine is aromatic bitter, that of the spurious, highly and disgustingly bitter. The concentrated infusion of the first is clear and reddish-brown, and when diluted becomes yellow. If an alkali be added, it is changed to a dark-red, and a solution of persulphate or permuriate of iron, imparts to it a high red colour, and after some time throws down a rose-coloured percipitate. The infusion of the last is not so clear, of a dirty brown colour, and when diluted does not become yellow. On the addition of

* See Med. Commentaries, vol. 15, p. 184.
† Edinburgh Med. and Surg. Journal, vol. 13, p. 211.

an alkali, it becomes greenish, and a solution of sulphate of iron gives it a dark green colour, and throws down a copious satin black precipitate.*

Animals are readily destroyed by this substance, and the symptoms are violent convulsions, resembling tetanus and which occur in paroxysms. The animal expires in one of these. On dissection, no inflammation is found.† Professor Emmert, of Tubingen, communicated the following case to Orfila: "A child died after having taken by mistake, a decoction of this bark; he preserved the use of his intellectual faculties, and earnestly begged that he might not be touched, for he experienced terrible cramps after each time that he was handled. He had a copious perspiration, but did not vomit."‡

Laurus camphora. Camphor when introduced into the stomach of dogs, produced general convulsions, loss of hearing, foaming at the mouth, and difficult breathing. Vomiting ensued and they recovered. But when the œsophagus was tied, the consequence was death, and the stomach presented an inflammatory appearance, and in one case, ulceration.

Although no case is recorded of death from camphor, in the human subject, yet the symptoms that large doses produce, are in general similar to those above stated. Cold sweats, faintness, delirium and feeble pulse, are the usual attendants.§

Cocculus indicus. The fruit of the *Menispermum cocculus*, a native of Malabar and Ceylon.‖ It is

* For a further list of its distinguishing characters, see Orfila, vol. 2, p. 280, and Edinburgh Med. and Surg. Journal, vol. 13, p. 210.

† See a paper on this poison, by Emmert, in the London Med. Repository, vol. 6, p. 89.

‡ Pelletier and Caventou have lately discovered an alkali in this substance, on which its poisonous properties depend, and which they style *brucine*. When given internally, it produces tetanus and death. It is not however the most rapidly poisonous of the vegetable alkalies, as it acts only with one twelfth of the energy of *strychnine*. Four grains were necessary to kill a rabbit. Annals, vol. 16, p. 30. Edinburgh Phil. Journ. vol. 3, p. 303.

§ Orfila, vol. 2, p. 297 to 305.

‖ Boullay has detected an alkali in this, which is called *picrotoxine*, or *picrotoxa*. It is highly poisonous. See Annals vol. 2, p. 468, and vol. 13, p. 70. London Med. Rep. vol. 11, p. 517, and vol. 13, p. 75.

used in India, for the purpose of intoxicating, and thus killing fish, and this is done by throwing the berries on the surface of the water. Goupil, a physician of Nemours, ascertained that it destroyed fish not only, but also carnivorous quadrupeds, and Orfila has proved the same on dogs. It acts, he observes, on the brain, and produces convulsions.* Goupil, however deems it an acrid poison.

POISONOUS MUSHROOMS.

The number and variety of these are so great, that it will unnecessarily enlarge our pages, to copy the botanical description of each. I will therefore only state a few characters which should lead us to doubt concerning their qualities, and for further particulars, refer to systematic writers on this subject.

The following indications should excite a suspicion of mushrooms: A marshy situation in the shade—the substance soft, porous and moist—an ugly appearance, and the surface more or less dirty—a glairy coat covering the surface—a virulent smell—a bright colour, or a combination of different colours. We should also regard as dangerous, all which have bulbous or soft stems, or have fragments of skin glued to their surface.†

The symptoms which generally arise from eating poisonous mushrooms, are thus given in a report to the Society of Medicine of Bourdeaux, and which is quoted by Orfila with high approbation. "Pains of the stomach, gripes, nausea, evacuations upwards and downwards, are the first symptoms with which the patients are attacked. Shortly after, heat of the bowels and faintings; the pains become more continued and violent; cramps, convulsions, sometimes general, sometimes partial, and unquenchable thirst succeed; the pulse is small, hard, tight, and very frequent. When the symptoms, after having lasted a certain time, do not diminish in consequence of the

* Orfila, vol. 2, 305 to 311. † Ibid. vol. 2, p. 335.

relief afforded, vertigo, a stupid delirium, and drowsiness affect some subjects, and are only interrupted by the pains and convulsions. In others there is no drowsiness; the pains and convulsions exhaust the strength; faintings and cold sweats come on, and death puts a period to this series of sufferings, after having been foreseen and announced by the patient himself, who has not lost his senses for a single moment."*

Poisonous mushrooms do not manifest their action generally until six or eight hours after they are eaten, and even twelve or sixteen sometimes elapse.

The appearances on dissection are as follows:— "Violet-coloured spots over the integuments, very extensive and numerous; the abdomen extremely bulky; the conjunctiva as it were injected; the pupil contracted; the stomach and intestines inflamed, and scattered over with gangrenous spots—sphacelus is present in some portions of this viscus, and the stomach and intestines are contracted, so much so indeed, that in these latter the thickened membranes have obliterated the canal. The œsophagus in one subject was inflamed and gangrenous; and in another there was an intus-susceptio of the ileon from above downwards, for the space of three inches. One individual alone had the intestines distended with excrementitious matter. In none have any remains of the mushroom been found; they had been either completely digested, or evacuated. The lungs were inflamed and distended with black blood; the same congestion had taken place in almost all the veins of the abdominal viscera, in the liver, spleen and mesentery. Inflammatory and gangrenous spots occur on the membranes of the brain, in its ventricles—on the pleura, lungs, diaphragm, mesentery, bladder, uterus, and even on the fœtus of a pregnant woman. The blood in this subject was extremely fluid; in other persons it was almost coagulated. Extreme

* Orfila, vol. 2, p. 334.

flexibility of the limbs was not a constant appearance."*

ALCOHOL.

On the effects of this poison, when taken as it ordinarily is by persons in habits of intoxication, it is not necessary for me to enlarge. I have only to refer to the effects of it in a pure state and in large doses, and then by comparing these results with the table published by Mr. Brande, of the quantity of alcohol contained in various kinds of liquors, an idea may be formed of the injury, and indeed danger, to which life is so freely and generally exposed.†

Mr. Brodie injected proof-spirits into the stomach of a rabbit. In five minutes, he lay motionless and insensible; the pupils of the eyes were dilated; there were slight convulsive motions of the extremities; the respiration was laborious, and he finally died at the end of an hour and fifteen minutes. In his further experiments, he found the stomach highly inflamed by the injection of this poison, but never observed any præternatural appearances in the brain. The symptoms, however, produced by spirits, are very analogous, he observes, to those caused by injuries of the brain.‡

The degree of danger from intoxication, says an experienced observer, may be best estimated by the irritability of the iris. If the iris retain its contractile power, the patient will generally recover, however overpowered his senses may be; but if it remain in a state of extreme dilatation when a strong light is directed upon it, a feeble hope of recovery can only be

* Orfila, vol. 2, p. 334. Cases of poisoning by mushrooms may be found in this author, vol. 2, p. 313 to 333. Foderè, vol. 4, p. 62 to 70. Stalpart, vol. 1, p. 162. Trans. Coll. Phys. London, vol. 2, p. 216, case by Dr. Heberden. London Med. and Phys. Journal, vol. 12, p. 385, case by Dr. Bardsley.

† See Mr. Brande's Tables in his Journal, vol. 5, p. 152. Rum contains 53.68 per cent of alcohol, brandy 53.39, gin 51.60, cider only 9.87 per cent, ale 8.88, Madeira wine from 16 to 18, Port wine from 19 to 25 per cent.

‡ Eclectic Repertory, vol 2, p. 269.

entertained. This paralysis of the iris is generally accompanied with apoplectic stertor, laboured and imperfect respiration, and a slow oppressed pulse. Next to the insensibility of the iris, want of energy in the stomach indicates the greatest danger.*

Sulphuric æther, introduced into the stomach when the œsophagus was tied, produced vertigo, great weakness, difficult breathing, drowsiness and death. The mucous membrane of the stomach was highly inflamed, as was also the duodenum; the blood in the heart was black, partly fluid and partly coagulated.†

Secale cornutum. (Ergot, spurred rye.) This substance either alone, or contaminating rye, has long been deemed a poison. It is stated to have given rise to epidemic diseases at various times, in France, Silesia, Prussia, Bohemia, Saxony and Sweden. Perrault mentions, that in travelling through Sologne in France, he was informed by some physicians and surgeons of that country, that the rye there was sometimes so corrupted, that those who ate bread made of it, were seized with a gangrene, some in one part and some in another, some losing a finger, others a hand or the nose, and that this gangrene was not preceded by any fever, inflammation or considerable pain, but that the parts fell off of themselves. The early symptoms were numbness, cold and livid skin, pain and swelling.‡

Tissot, in a paper in the Philosophical Transactions, presents a very copious account of the disease in question, and divides it into two forms—the spasmodic and gangrenous. He observes that the first

* Bedingfield in Edinburgh Med. and Surg. Journal, vol. 12. p. 493. See on the symptoms from intoxication, a curious paper from the French, in New-England Journal, vol. 8, p. 389.

† Orfila, vol. 2, p. 342. Dr. Godman has lately announced a curious result from the inspiration of the vapour of sulphuric æther. It produces all the effects of nitrous oxide. Its exhilerating effects were striking, but in one individual, a female, predisposed to consumption, the muscular action induced, left a cough, derangement of mind and pain. She had several attacks of violent syncope and remained ill for some time. Godman's Western Reporter, vol. 2, p. 111.

‡ Phil. Trans. vol. 11, p. 758. See also vol. 52, p. 529, where cases are related that occurred at Orleans and Blois.

accurate account of it was published, in 1596. The spasmodic disease prevailed, according to Hoffman, in 1648, 1649, and 1675, in Voigtland—in 1702 in Friburg,—in 1716 in Saxony and Lusatia, and in 1722 in Silesia. It was frequently attended with epilepsy. The gangrenous form, was known in France as early as 1630, and in 1650, 1670 and 1674, it raged in Aquitaine and Sologne. In 1709 it appeared in Switzerland. The symptoms were similar to those already noticed. It attacked persons of both sexes and all ages, and in some instances, only the lower extremities became gangrenous, while in others, both upper and lower were affected.*

Mr. Srine has described its effects as occurring in 1736 in Bohemia. It commenced with an uneasy, stinging sensation about the feet. To this, severe cardialgia succeeded, and the hands and head were soon after affected. The fingers were strongly contracted, and there was a sensation of burning in the hands and feet. Giddiness, mania or coma, succeeded, accompanied with opisthotonos, and a foaming at the mouth. These symptoms were followed by a canine appetite. All those who had epileptic symptoms, died. The pulse was natural, and the spasms left a stiffness of the limbs. The disease continued two, four, eight, and sometimes even twelve weeks. Out of five hundred persons, three children died.† Gangrene of the extremities has also been observed in animals from the administration of ergot.‡

There is some diversity of opinion as to the real nature of this substance. Decandolle states that it is

* Phil. Trans. vol. 55, p. 106.

† Orfila, vol. 2, p. 349. For some important remarks, referring the above diseases to deficiency of nourishment, rather than to diseased grain, see Rees' Cyclopedia, art. *Ignis sacer.* I shall consider this subject more at length at another time.

‡ It has been a subject of some interest and inquiry, whether the spotted fever which ravaged several districts in the United States some years since, had its origin in part or altogether from eating this substance, combined with grain. The facts adduced are very unsatisfactory, and lead to no definite conclusion. Some observations on this subject are contained in the New-England Journal, vol. 5, p. 133, p. 156, (an article by *Prof. Bigelow,*) and p. 235.

a parasitic plant; a mushroom, of the genus *sclerotium*. Others assert that it is a disease of the rye. The analysis of Vauquelin has not led to a decisive result.*

Lolium temulentum. (Darnel.) Naturalized in the United States. Bread made from the farina of the seed of this plant, and taken to the amount of six drachms, caused distraction of thought, indistinct vision, torpor, debility and drowsiness, and these were followed by efforts to vomit. Tremors of the limbs, great depression, and difficulty of speech and vomiting, succeeded.† Similar effects were induced in a family from eating oat-bread mixed with darnel. The tongue exhibited a very strong trembling, and Seeger indeed remarks, that the trembling of the body is one of the most certain signs of poisoning by this plant.‡ Animals, and particularly dogs, are affected in the same manner as man. Chickens, however, eat the seeds with greediness, and without any bad consequences.‖

Diseased wheat. When the farinaceous part of this plant becomes converted to a black powder, it imparts injurious qualities to the bread. Foderè states that he saw, in 1808, colics and diarrhœas which arose from this cause.

Anagallis arvensis. (Meadow pimpernel.) Naturalized in the United States. Its extract produces in animals, dejection, insensibility and death. The mucous membrane of the stomach and rectum were found inflamed, and the lungs livid.

Aristolochia clematitis. (Common birthwort.) Vomiting, convulsive motions, weakness of the posterior

* See on this subject, Brande's Journal, vol. 2, p. 273, 320; vol. 3, p. 157. Eclectic Repertory, vol. 7, p. 429. Silliman's Journal, vol. 2, p. 45. In this last, Dr. Tully maintains the opinion of Decandolle.

† London Med. Repository, vol. 13, p. 260. This is the result of an experiment by Dr. Cordier on himself, with six drachms, taken early in the morning.

‡ Orfila, vol. 2, p. 352. Another case of the noxious effects of darnel, is related in the Edinburgh Med. and Surg. Journal, vol. 1, p. 106. It happened at Genoa, during the scarcity occasioned by its blockade in 1800.

‖ Edinburgh Med. and Surg. Journal, vol. 1, p. 107.

extremities, dejection and death, were induced by its root. The stomach and rectum somewhat inflamed.

Æthusa cynapium. (Common fool's parsley.) This plant has been the cause of injury, from its being mistaken for parsley. Orfila gives the following as distinctive characters :—1. The leaves of the fool's parsley are of a blackish green on the upper side, and shining. 2. They have no smell without being bruised, but they give out a nauseous smell when rubbed between the fingers. Parsley, on the contrary, presents an agreeable odour. 3. Its root is smaller than that of parsley, and dies every year in autumn.

Its effects are, heat in the throat, pain, cramps in the stomach, swelling of the body and difficult respiration, drowsiness and starting. Delirium is occasionally present. The symptoms are more violent if vomiting does not occur.*

Riviere examined a body poisoned by it. The tongue was black ; a brownish serosity was found in the stomach, and the liver was hard, and of a yellow colour.

Ruta graveolens. (Rue.) The distilled water and watery extract in large quantity, caused death in animals after a long interval, but its effects are not powerful.

Nerium oleander. (Common oleander. Rose-bay.) The extract of this plant produced in animals, vomiting, vertigo, weakness of the extremities, convulsions and death. The distilled water and powder are less active. The digestive canal was not affected.

Morgagni relates the case of a female, who drank some of the juice of this plant. Vomiting soon succeeded. Her lips were brown ; the pulse small and weak ; the power of speech was lost, and she lay insensible. Death ensued nine hours after taking the juice. On dissection, the back of the body was universally of a violet colour, but the anterior, natural.

* Orfila, vol. 2, p. 250. Cases by *Mr. Stevenson*, in London Med. and Phys. Journal, vol. 15, p. 425. *Dr. Buchhave*, in Med. Commentaries, vol. 14, p. 37.

There was some heat of the body, though seventeen hours had elapsed since death; the blood-vessels of the stomach, intestines and omentum, were much distended; the stomach contained a greenish fluid, but its membranes were sound; the right lung was red and adhering, while the left was completely collapsed. All the other viscera were natural.*

Mercurialis perennis. (Mountain mercury.) This plant is hurtful both to man and animals. It causes vomiting, diarrhœa, profound sleep, and convulsions. Ray relates the case of a man, his wife and three children, who experienced deleterious effects from eating it, fried with bacon.†

Chærophyllum sylvestre. (Wild chervil.) The root of this plant has produced delirium, profound sleep, numbness and suffocation.

Sium latifolium. A native of the United States. This has also caused violent delirium on eating the root in August. Before that, it is not deemed noxious.

Coriaria myrtifolia. Sauvages states, that a labouring man and a child died in horrible convulsions, within half an hour after eating some of the berries of this plant.‡

I shall add to these a bare catalogue of some foreign poisons, which are extremely interesting in a physiological point of view, but from their rarity, little calculated to become the instruments of death in our own country.

Upas tieute, and *Upas antiar.* The first of these was brought from Java by *Leschenault,* and is said by him to be the extractive juice of a creeping plant, a species of *Strychnos.* The last is the juice of a large tree in Java, denominated by Leschenault, *Antiaris toxicaria.*‖ The ancient opinion concerning

* Morgagni, vol 3, p. 387.

† Lond. Med and Phys. Jour. vol. 15. p. 71. The case of a family poisoned by it, (of whom some died,) is mentioned in Phil. Trans. vol. 17, p. 875.

‡ Orfila, vol. 2, p. 354.

‖ Upas is probably a common adjunct in the Javanese language to all poisonous plants.

the deadly influence of the bohon-upas, is now generally abandoned; but the products in question are, notwithstanding, virulent poisons. Numerous experiments have been performed with them on animals, by Brodie, Magendie, Delille, Orfila, and Horsfield. The tieute induces tetanus, asphyxia and death, with great rapidity; and on dissection, Dr. Horsfield found the brain highly inflamed. The antiar operates rather more slowly, and according to Mr. Brodie, death is caused by rendering the heart insensible to the stimulus of the blood, and stopping its circulation. But on these points I must refer to the authorities quoted below.*

Strychnos nux vomica. A native of Ceylon, the coast of Coromandel and Malabar. The seeds are what is commonly called *nux vomica*, and this is the poisonous ingredient. Its action is rapid and produces death suddenly in man and animals. A singular case is mentioned by Dr. Granville, of a patient at the hospital St. Louis, at Paris, whose right side was paralytic, and who took twenty-four pills of it. He would have suffered severely, if proper remedies had not been instantly administered, but the convulsions which always accompany this poison, continued, and afterwards affected only the diseased part, so that the arm which before was lifeless, was now strangely and constantly agitated.† This poison has been made the subject of experiment by many physiologists.‡

* Quarterly Review, vol. 6, p. 514. Amer. Edit. Annals of Philosophy, vol. 9, p. 202 and 265, containing Dr. Horsfield's essays on oopas, or the poison tree of Java, extracted from the Batavian Transactions. Horsfield writes these poisons thus, *antshar and tshittik*. Orfila, vol. 2, p. 260, 287. Eclectic Repertory, vol. 2, p. 281, Brodie's experiments from Phil Trans. Hosack's Med. and Phil. Register, vol. 1, p. 171, containing Delille's dissertation on the upas tieute. Annals of Philosophy, vol 4, p. 259. See also Med. Comment. vol. 15, p. 36.

† London Med. Repertory, vol. 7, p. 163. This poison seems to have been known in the time of Valentini. See his Pandects, vol. 1, p. 622. *De nuce vomica penes furem deprehensa.*

‡ See experiments of *Magendie and Delille* in Eclectic Repertory, vol. 3, p. 274, of *Somerville, Harlan, Coates, Lawrence and Hubbard*, in Chapman's Journal, vol. 2, p. 192, vol. 3, p. 296, vol. 4, p. 242, and of *Segalas*, in New-York Med. and Phys. Journal, vol. 2, p. 139.

Strychnos ignatia, or *Ignatia amara*.* (Bean of St. Ignatius.) Its operation is similar to the nux vomica, and like it, does not produce inflammation of the texture to which it is applied.†

Ticunas, according to De la Condamine, is an extract obtained from various plants, by the Indians of South America. The experiments of Fontana with it, indicate that it produces death in animals, either externally applied or internally given. The ordinary symptoms are convulsions, faintings, great debility, and loss of feeling.‡

Woorara is a poison, with which the Indians of Guiana arm the points of their arrows. It does not appear to differ essentially from the ticunas. Mr. Brodie has performed several experiments with it, and he imagines it to produce death by destroying the functions of the brain.‖

Hippomane mancinella. (Manchineel tree.). Dr. Peysonnel relates that a soldier, who was a slave with the Turks, eat some of the apples of this tree, and was soon seized with a swelling and pain of the abdomen. His lips were ulcerated with the fruit, and a cold sweat came over him. Having taken some remedy, (the avellana purgatrix,) vomiting and purging were induced to a violent degree. He however gradually recovered.§

The wood of this tree when green, will excite in-

* Pelletier and Caventou discovered an alkali in the nux vomica, and also in the Bean of St. Ignatius, which is denominated *Strychnine*. It is a most rapid poison. Magendie killed a dog with one eighth of a grain, and the editor of the Edinburgh Med. and Surg. Journal states, that he has himself seen one die in two minutes after the injection of one sixth of a grain into the cavity of the pleura. Edin. Med. and Surg. Journal, vol. 18, p. 159. See Annals, vol. 16, p. 28. Brande's Journal vol. 7, p. 375.

† The fruit of the plant *feuillea cordifolia*, has lately been announced by Drapiez as an antidote against vegetable poisons. He poisoned dogs with the rhus toxicodendron, hemlock and nux vomica, and recovered them with this fruit. Annals, vol. 15, p. 389. This, however, is not original with M. Drapiez, as Moseley mentions the same plant as an antidote.—Mosely on Tropical Diseases, p. 37.

‡ See the experiments of *Fontana* in Phil. Trans. vol. 70, p. 163, also Dr. *Brocklesby's* in ibid. vol. 44, p. 408, and *Herissant's*, ibid. vol. 47, p. 75.

‖ Eclectic Repertory, vol. 2, p. 289.

§ Philosophical Transactions, vol. 50, p. 772.

flammation on the skin when rubbed against it ;* and it affords a most beautiful article of furniture, being interspersed with green and yellow veins like marble, but the dust is of so acrid and poisonous a nature, that the sawyers and carpenters are forced to work with gauze masks, to protect them from its injurious effects.†

Curare. The war poison of the Indians on the banks of the Oronooko, in South America. Some interesting details concerning its preparation, are contained in the note, extracted from one of the latest volumes of Humboldt's Personal Narrative.‡

To these I venture to add the following:

Calidium seguinum. I add this on the authority of some remarks extracted from Hooker's Exotic Flora. This plant is a native of the West Indies, and is there called *dumb cane,* from the fact that its

* Phil. Transactions, vol. 3, p. 824.

† Edinburgh Review, vol. 17, p. 374, Amer. ed.

‡ Esmeralda is the most celebrated spot on the Oronooko for the fabrication of this poison. The Indians collect the liana (bejuco) for the preparation of this (the *curare,*) and it bears the same name as in the forest of Javita. It is the *Bejuco de mavacure,* which is gathered in abundance on the east of the Mission, on the left bank of the Oronooko and in other places. "The juice of the liana when it has been recently gathered, is not regarded as poisonous ; perhaps it acts in a sensible manner only when it is strongly concentrated. It is the bark and a part of the alburnum, which contains this terrible poison. Branches of the *mavacure,* four or five lines in diameter, are scraped with a knife, and the bark that comes off, is bruised and reduced into very thin filaments, on the stone employed for grinding cassava. The venomous juice being yellow, the whole fibrous mass takes this colour. It is thrown into a funnel made of the leaf of a plantain tree, nine inches high, with an opening four inches wide. A cold infusion is first prepared by pouring water on the fibrous matter, which is the ground bark of the mavacure—a yellowish water filters during several hours, drop by drop, through the leafy funnel. This filtered water is the venomous liquor, but it acquires strength only when it is concentrated by evaporation, like molasses in a large earthern pot. The Indians from time to time, invited us to taste the liquid. Its taste, more or less bitter, decides when the concentration by fire has been carried sufficiently far. There is no danger in this, the *curare* being deleterious only when it comes into immediate contact with the blood. The vapours, therefore, that are disengaged from the pans, are not hurtful, notwithstanding what has been asserted on this point by the Missionaries of the Oronooko. Fontana, in his fine experiments with the poisons of the *ticunas* of the river of Amazon, long ago proved, that the vapours arising from this poison, when thrown on burning charcoal, may be inhaled without apprehension, and that it is false, as M. de la Condamine has announced, that Indian women when condemned to death, have been killed by the vapours of the poison of the ticunas.

The juice is thickened with a glutinous substance to cause it to stick to

virulent juice, when applied to the tongue, causes a swelling which deprives the sufferer of the power of speech.*

Ava, or *yava root*, of Otaheite. This is said to be the product of a species of pepper, (*Piper methysticum*,) and it is chewed to great excess in that island. Its effects when long persisted in, are redness of the eyes, general emaciation, trembling and paralysis, formation of a scurf over the body, and fatuity.†

Spigelia marilandica. (Pink root.) A native of the United States. This in large doses, is a violent poison. Its decoction produced vertigo, dimness of sight, and pain, in two children who took it. One vomited, but was not relieved. Staggering, incoherent talking, and delirium took place, until they fell asleep. They awoke relieved. The pupils were dilated during the influence of the poison.‡ Dr. Chalmers attributes the loss of two children who died in convulsions, to this article.‖

Kalmia latifolia. (Mountain laurel. Laurel, in Pennsylvania—Bay, in Virginia.) A native of the U. States. Barton says that the Delawares (Indians) poison themselves with a decoction of this plant.§ It is poisonous to some animals, as cattle and sheep;

the darts, which it renders mortal, but taken internally, the Indians consider the *curare* to be an excellent stomachic. Scarcely a fowl is eaten, (adds our author) on the banks of the Oronooko, which has not been killed by a poisoned arrow. The missionaries pretend, that the flesh of animals is never so good, as when these means are employed. Father Zea, who accompanied us, though ill of a tertian fever, caused every morning, the live fowl allotted for our repast to be brought to his hammock, together with an arrow. Notwithstanding his habitual state of weakness, he would not confide this operation, to which he attached great importance, to any other person. Large birds, when wounded in the thigh, perish in two or three minutes, but it is often ten or twelve before a pig or a pecari expires." M. Humboldt does not seem to be acquainted with any certain antidote, if such exists, to this fatal poison. Sugar, garlic, the muriate of soda, &c. are mentioned doubtingly. Tilloch's Phil. Magazine, vol. 58, p. 233. See also Orfila, vol. 2, p. 479.

* Edinburgh Phil. Journal, vol. 7, p. 395.

† Turnbull's Voyage round the World, vol. 1, p. 160, Lond. ed. Quarterly Review, vol. 16, p. 79, *Amer. ed.*

‡ Barton's Med. and Phys. Journal, vol. 1, part 2, p. 74.

‖ Dr. W. P. Barton's Med. Botany, vol. 2, p. 80. Dr. Bigelow's Medical Botany, vol. 1, p. 146.

§ Barton's Med. and Phys. Journal, vol. 1, part 1, p. 147.

and in the human system, a very small quantity of the decoction has produced vertigo.*

Sanguinaria canadensis. (Blood-root.) A native of the United States. This is considered by Dr. Bigelow as an acrid narcotic. A dose of from eight to twenty grains of the fresh powdered root, produces irritation of the fauces, heartburn, nausea, faintness, and frequently vertigo and diminished vision. Vomiting is occasionally produced.†

On a review of the poisons included in this class, it will be seen that greater diversity exists, both as to symptoms and appearances on dissection, than in either of the former. And there appears to be a leading distinction, which, as it were, subdivides it into four classes. Thus, "some are rapidly absorbed, and carried into the circulation: those animals that experience their effects, are in possession of nearly all their intellectual faculties, but the contraction of the muscles is such, that the thorax becomes immovable, asphyxia takes place, and death is produced, without the least trace of redness being discovered in the digestive canal. The Upas tieute, the bean of St. Ignatius, nux vomica, and the Brucea antidysenterica, are of this description." Some again produce a strong excitement of the brain, to which somnolency and loss of the intellectual faculties succeed. Inflammation of the digestive canal is rarely discovered. And of this class are camphor, Cocculus indicus, and the Upas antiar. A third class produce excitement and lethargy, accompanied with a local irritation more or less intense; and to this belong belladonna, tobacco, stramonium and hemlock. The last division are those which instantly destroy life, by acting on the nervous extremities; as the oil of bitter almonds, and the oil of tobacco. The third of these, remarks Orfila, is alone *strictly* entitled to the title of narcotico-acrid.‡

* Bigelow's Med. Botany, vol. 1, p. 137, 139.
† Bigelow's Med. Botany, vol. 1, p. 79.
‡ Orfila, vol. 2, p. 358.

Treatment. My remarks here must of course be very brief.

The datura, belladonna, tobacco, digitalis, aristolochia, and cicuta, must be encountered with an emetic, and the vomiting must be aided by proper drinks. If symptoms of cerebral congestion supervene, venesection is advisable, and afterwards diluted acidulated drinks, frequently repeated. Inflammation is to be met by its proper remedies.

The upas, nux vomica, brucea, ticunas, camphor and cocculus, and the whole of that class, require emetics, and Magendie and Delille afterwards recommend tracheotomy. In cases of wounds from them, the cautery is proper.

Mushrooms are best combatted by emetics, cathartics and glysters. Orfila places great dependence on cathartics.

When the patient is in an alarming state of intoxication, emetics and irritating enemas are indicated, and venesection is sometimes required.* Acidulated drinks are subsequently useful.

* See on this subject, Edinburgh Med. and Surg. Journal, vol. 12, p. 493.

CHAPTER VII.

ANIMAL POISONS.

Cantharides—symptoms—effects on animals—appearances on dissection—treatment. Lytta vittata. Poisonous serpents—the viper—rattlesnake—variety in the effects of its bite—mockasin snake—antidotes against the bite of serpents—treatment of persons bitten. Scorpion. Tarantula. Bee—humble bee—wasp—hornet. Poisonous fishes—catalogue of these—cause of fish poison—treatment. Muscles—oysters—crab—lobster—mackerel—dangerous effects of these at certain seasons of the year. Ornithorynchus paradoxus. Toad. Pheasant or partridge—its poisonous nature at some seasons—cause. Poisonous honey—cause—effects—treatment. Dangers of dissection—consequences occasionally produced by slight injuries during dissection—treatment.

Animal poisons are, as I have already stated, arranged by Foderè and Orfila under the class of septic and putrefying poisons, with the exception of cantharides, which is, with great propriety, placed among the corrosive. I shall commence with it, and notice the rest in their order.

CANTHARIDES.

Cantharis vesicatoria. (Spanish fly.) Cantharides, according to Robiquet, consists of various substances—a green fluid oil—a black matter, soluble in water and insoluble in alkohol—a yellow matter, soluble in both—a fatty matter, insoluble in alkohol—phosphates of lime and magnesia—acetic and uric acids. None of these are vesicatory, but the epispastic principle is a white crystallizable substance, insoluble in water, (soluble, however, in it, when mixed with the yellow matter;) soluble in boiling alkohol, and in the oils.* Dr. Thomson styles this *cantharidin.* We are, however, to treat of it as it is or-

* Orfila, vol. 2, p. 422. The experiments of Robiquet are quoted in detail in the Eclectic Repertory, vol. 2, p. 405.

dinarily administered, viz. in the form of powder and of tincture, and the usual symptoms are the following: When taken internally, cantharides excite a disagreeable and nauseating smell, acrid taste, retchings, copious vomitings, which are often tinged with blood, alvine evacuations, also more or less bloody, burning heat in the stomach and other parts, accompanied with griping and excruciating pains; great heat in the bladder, difficulty in making water, and the urine often bloody, sometimes totally suppressed; obstinate, and sometimes painful and excessive priapism, satyriasis, the pulse frequent and hard, while in some cases, the jaws are closed; and convulsions, general rigidity of the limbs, and delirium, precede the death of the patient *

It is not necessary to detail cases illustrative of this catalogue of symptoms, nor indeed are they of a nature that would afford any useful result. In many instances, they originated in a desire to stimulate the exhausted passions of the debauchee, or with more malignant and villainous intentions, were administered for the accomplishment of seduction.

The external application of cantharides, sometimes gives rise to similar consequences, but in a more mitigated form.

As to its effects on animals, Orfila found, that when injected in the form of tincture into the jugular veins, it produced vertigo, stupor and death. The blood in the left ventricle of the heart was fluid and reddish—that in the right was black, and contained coagula. On using alkohol alone, however, he observed precisely the same effects. He then tried oil digested upon cantharides. The animal was soon deprived of sensibility and muscular power, and tetanus, convulsions, difficult respiration, and death, supervened. The lungs were found very bulky and distended,

* Orfila, vol. 2, p. 430 to 439. Le Clerc, p. 74, 75. New-England Jour. vol. 11, p. 18. Dr. Francis, however, mentions a case where six ounces of the tincture were taken without injury. New-York Med. and Phys. Journal, vol. 2, p. 28.

with a great quantity of reddish serosity ; in some parts, they were livid and compact. The mucous membrane of the bladder was slightly red, while that of the stomach and duodenum was natural. When cantharides in powder were introduced into the stomach, they produced vomiting, the discharge of much bloody mucus, pain, great dejection, extraordinary insensibility, and death. The mucous membrane of the stomach was of a fiery red, that of the duodenum less so, but also inflamed. The bladder was sometimes seen inflamed and thickened ; and the œsophagus also was occasionally inflamed.*

As to the appearances on dissection in man, they are generally similar to those from other corrosive poisons—inflammation of the stomach and intestines. Fungous tubercles, erosions, and small ulcerations, have also been noticed in these parts. The bladder has been inflamed or ulcerated, and in some cases, the external organs of generation have been gangrenous.

If on dissection, or in the matter vomited, any portion of this poison remain, it may be detected by its shining points, which are of a beautiful green colour. This, however, can only be hoped for, when it has been taken in the form of powder. When the tincture has been administered, we cannot expect to identify the substance, and must rely solely on the symptoms and the dissection.

Treatment. Oil is recommended by Orfila, but later experiments have demonstrated its injurious effects. According to Dr. Pallas, it increases the danger. Cantharides macerated in cold oil and afterwards given to dogs, was found to destroy them in a few minutes.† And this is owing to the oil dissolving the active principle. Mucilaginous drinks are preferable to excite vomiting, and to remove the irritation from the bladder. The warm bath, friction

* Orfila, vol. 2, p. 424 to 430.

† London Med. Repos. vol. 19, p. 259. Quarterly Journal Foreign Med. and Surg. vol. 5, p. 304.

and diluents are proper, and the antiphlogistic treatment is necessary, when any appearances of inflammation present themselves.

The *Lytta Vittata*, (Meloe americana, Potatoe fly,) and some other species of our own country, appear to possess properties analogous to cantharides.*

POISONOUS SERPENTS.

On these, I intend to be very brief, and shall merely give a short notice of those that are found poisonous in other countries. Somewhat more of detail will be proper in reference to such as are peculiar to the United States.

The Viper. (*Coluber berus. Vipera berus,*) is the most common poisonous serpent of England, and the European continent. Its bite is not uniformly fatal to man or the larger animals, but the season of the year appears to increase its intensity, being most venomous in summer. The symptoms are acute pain in the part wounded. which extends over the limbs and even to the external organs—tumefaction and redness, which afterwards passes to a livid colour—syncope, frequent, small, concentrated and irregular pulse—difficulty of breathing, copious and cold sweats, disturbance of vision and of the intellectual faculties, bilious and convulsive vomitings, and followed generally by yellowness of the skin. Gangrene is apt to occur in the wound, when the disease is about to terminate in death.†

The *poisonous snakes of India* have been noticed by Russell in a great work, and his experiments are

* See the papers of Dr. Chapman and Dr. Woodhouse, in the New-York Medical Repository, vol. 2, p. 163, vol. 3, p. 213—of Dr. Schott, in Eclectic Repertory, vol. 2, p. 193—of Dr. J.F. Dana, in Silliman's Journal, vol. 2, p. 137. This contains an analysis of the potatoe fly, showing that Cantharidin exists in it.

† On the effects of the venom of the viper, see Morgagni, vol.3, p. 410. Orfila, vol. 2, p. 380. Edinburgh Medical Essays, vol. 6, p. 420. Fontana, in Phil. Transactions, vol. 70, p. 163. Redi in do. vol. 1, p. 160. Atwell in do. vol. 39, p. 394. Also, London Med. Repos. vol. 14, p. 522—Configliacchi's Experiments. New-England Journal, vol. 6, p. 311—Mangili's Experiments.

still the most valuable we yet have on the subject.* Notices are interspersed in abundance in various literary and scientific works, concerning the venomous serpents of other countries.†

In general, the animal is most poisonous, and its effects most rapidly destructive, in warm climates. Hence the serpents of India and South America are distinguished above all others, for their venomous nature.

Crotalus horridus. (The Rattle snake.) This is probably the most venomous snake known in our country, but its effects vary greatly; and this is doubtless, as has been suggested by Sir Everard Home, owing to the greater or less intensity of the poison.

"When the poison is very active, the local irritation is so sudden and violent, and its effects on the general system are so great, that death soon takes place. On examination after death, the only alteration of structure met with, is in the parts close to the bite, where the cellular membrane is completely destroyed, and the neighboring muscles are very considerably inflamed.

When the poison is less intense, the shock to the general system does not prove fatal. It brings on a slight degree of delirium, and the pain in the part bitten is very severe; in about half an hour, swelling takes place from the effusion of serum in the cellular membrane, which continues to increase with greater or less rapidity for about twelve hours, extending during that period into the neighbourhood of the bite; the blood ceases to flow in the smaller vessels of the swollen parts; the skin over them becomes quite cold; the action of the heart is so weak that the pulse is

* An analysis of many of these is contained in Orfila, vol. 2, p. 387 to 403. See also, the Eclectic Repertory, vol. 2, p. 318, and Dr. Rankin's Exp. in Edinburgh Med. and Surg. Journal, vol. 18, p. 231.

† An extraordinary case is related by Dr. Pascalis, in the New-York Med. Repository, vol. 19, p. 78, of an individual who was bitten by a snake at St. Domingo. He survived the effects many years, but the leg and thigh swelled to an enormous size, and this remained permanent until his death. The only relief he experienced, was to open one or other of the capillary vessels on the swelling, and discharge four or five ounces of blood from it.

scarcely perceptible, and the stomach is so irritable, that nothing is retained on it. In about sixty hours, these symptoms go off; inflammation and suppuration take place in the injured parts; and when the abscess formed is very great, it proves fatal.* When the bite has been in the finger, that part has immediately mortified. When death has taken place under such circumstances, the absorbent vessels and their glands have undergone no effects similar to morbid poisons, nor has any part lost its natural appearance, except those immediately connected with the abscess.

In those patients who recover, the symptoms go off more readily and more completely than those produced by a morbid poison, which has been received into the system."†

A case is related by Sir Everard Home, which illustrates the above views. Thomas Soper, aged twenty-six, was accidentally bitten twice in the hand by a rattle snake. The snake was kept for the purpose of exhibition, in London.

The first symptom observed was an incoherence in language and behaviour, resembling intoxication. In less than half an hour, the hand began to swell, next the fore-arm, and afterwards the pain extended to the axilla. In two hours after the bite, Mr. Brodie saw him. The skin was cold, the man's answers incoherent, his pulse one hundred in a minute, and he complained of sickness. Ammonia and ether were exhibited internally and applied to the wound. He rejected the first draught, but retained the second. Fits of fainting supervened, with coldness of the skin. On the next day, blood was extravasated under the skin as low as the loins, and vesications had formed on the wounded arm. Depression and faintings continued. These symptoms were present for several days with greater or less severity. The arm slough-

* A case strongly illustrative of this class of symptoms, is related by Mr. Breitnal, of Philadelphia, the actual sufferer himself, in the Phil. Trans. vol. 44, p. 147. He survived the bite and recovered, but an abscess formed several months afterwards in the injured part.

† Home, in Phil. Trans. for 1810. Eclectic Repertory, vol. 1, p. 320.

ed in various places, and abscesses formed, accompanied with purging. Finally, mortification and delirium occurred, and he died on the fourth of November, 1807—eighteen days after being bitten.

On dissection, the body externally was found natural, with the exception of the arm that had been bitten. The wounds made by the fangs were healed; the lungs were healthy; the cavities of the heart contained coagulated blood; the cardiac portion of the stomach was moderately distended with fluid; while the pyloric portion was much contracted, the internal membrane had its vessels very turgid with blood. The intestines and liver were healthy. The vessels of the brain were turgid, and water was effused in it.*

The effects of the bite of the rattle snake on animals are so well known, and in general, resemble so closely those produced on man, that it is not necessary to recapitulate them.†

The *Mockasin snake*, is another venomous animal peculiar to our country, and the effects of its bite are similar to those of the rattle snake.‡

As to antidotes, and the treatment proper for bitten persons, we may remark, that these are numerous and diversified. Humboldt and Bonpland mention a New-Grenada plant, the *Guaco* (mikiana guaco.) the juice of which seems to deter snakes from biting persons on whom it is applied, and even when they are bitten, the application of the leaves prevents the usual effects.‖

* Eclectic Repertory, vol. 1, p. 312.

† See on this point, Phil. Trans. vol. 35, p. 309, 377. Dr. B. S Barton mentions two cases of rabbits bitten by rattle snakes. One recovered gradually in three days, the other died in 74 minutes. On dissection, the great curvature of the stomach was seen inflamed. Around the bite, blood was effused, and the solids were in a gelatinous, bloody state. (Barton's Med. and Phys. Jour. vol. 1, part 1, p. 167.

‡ New-York Medical Repository, vol. 8, p. 441. *Quere*, is the copperhead snake, *(scytale mockeson* of Say, and *scytale cupreus* of Rafinesque,) and the mockasin snake the same animal? Silliman's Journal, vol. 1, p. 84, 256, contains some papers on these, but it is not stated whether they are identical or distinct. Say, however observes, that the *coluber heterodon* is also often called mockasin.

‖ Orfila, vol. 2, p. 441

Arsenite of potash, (Fowler's solution,) has been used with great success by Mr. Ireland, in the West Indies, to counteract the effects of the bites of snakes.* The Pill of Tanjore, also an arsenical preparation, was sometimes used by Dr. Russel with apparent success on animals, but several however, to whom it was administered, died in the same way as if nothing had been taken.†

Ammonia, and *Eau de Luce* have many testimonies in their favour, while some, as Sir Everard Home and Orfila, doubt their specific virtues.‡ They are however useful in promoting perspiration. Besides these many plants have acquired a temporary reputation in our own country, and in South America. Of the former, are the Aristolochia serpentaria, Prenanthes alba, and Polygala senega; and in South America, the Eupatorium ayaparia, the Algalia or Yerba del sapo, and the Raiz preta.§

Caustics are valuable, but often prove ineffectual, and the treatment at present most relied on, is the application of ligatures above the part bitten, but not too tight, nor too long continued. Then cauterize the wound, with a hot iron or lunar caustic, and afterwards apply compresses to the part. Perspiration and sleep should be encouraged by small doses of

* See his cases in the Medico-Chirurg. Transactions, vol. 2, p. 396.

† Orfila, vol. 2, p. 446. New-York Med. Rep. vol. 7, p. 12.

‡ Testimonies in favour of these may be found in the Med. Commentaries, vol. 14, p. 297. London Med. Repos. vol. 8, p. 73. New-York Med. Repository, vol. 9, p. 109. Edinburgh Med. and Surg. Journal, vol. 18, p. 231. London Med. and Phys. Journ. vol. 29, p. 120.

§ Dr. Brickell states, that *prenanthes alba* is a famous Indian cure for the bite of serpents, Barton's Med. and Phys. Journal, vol. 2, part 1, p. 101. Dr. Barton's paper in the American Philosophical Transactions, vol. 3, p. 100, contains a long list of supposed vegetable antidotes against the bite of the rattle snake. On the eupatorium ayaparia, see New-York Med. Repository, vol. 7, p. 16, and London Med. and Phys. Journ. vol. 29, p. 304. On the algalia, New-England Journal, vol. 3, p. 322. On the raiz preta, Edinburgh Phil. Journ. vol. 1, p. 218.

Besides these, many other remedies have apparently proved successful. Oil has been thus given, (New-York Med. Repos. vol. 2, p. 242.) A living fowl applied to the wound, (Silliman's Journal, vol. 1. p. 259.)

Most of these illustrate the remark of Sir Everard Home, that "the violent effects which the poison produces on the part bitten, and on the general system, and the shortness of their duration, has frequently induced the belief, that the recovery depended upon the medicines employed."

ammonia, Madeira wine and ether, and the patient should be kept in bed, well covered. Gangrene is to be combatted with antiseptics.*

The *Scorpion* is most venomous in southern countries. Instances are recorded, of its sting producing grievous local inflammation, and occasionally fever, trembling and pain, on man, in France and Italy. Animals, as dogs and cats, generally survive, though some have died from its poison.†

The *Tarantula* produces similar effects, local rather than general, and the fabulous stories respecting it are now well understood and duly appreciated. It would seem, however, that there are species whose sting may prove fatal. Dr. Graperon states, that he saw two fatal cases in the Crimea—one proved so in forty-eight hours, another in six days. The first was that of a peasant, who was stung while sleeping in his hut. The sting was soon very painful, his neck swelled and the respiration became difficult forty-four hours after the accident. On the right side of the neck, there was a brownish violet mark, the neck, head and shoulders were swelled, and the thorax from the clavicle to the false ribs, was of a bluish colour. Scarifications, the actual cautery, oil externally and internally, and ammonia, were all tried in vain.‡

The bite of the *spider* is also said to have caused local inflammation, together with general irritation, but I have not been able to find any well authenticated cases.

The sting of the *bee*, the *humble-bee*, the *wasp*, and the *hornet*, have each occasionally produced dangerous and alarming symptoms. Inflammation more or less extensive has followed, and if the part injured be a sensitive one, great misery is produced. Several

* Orfila, vol. 2, p. 450. A case of cure by ligature is mentioned in the Eclectic Repertory, vol. 4, p. 388. I may add in this place, that I have been favoured with a communication from Dr. Holbrook, of Venice, Cayuga county, in this state, in which he relates several cases, of persons bitten by snakes, who were remarkably and speedily relieved by the free administration of Peruvian bark in milk.

† Orfila, vol. 2, p. 411.

‡ Quarterly Journal Foreign Med. and Surg. vol. 1, p. 215

cases of this nature are cited by Orfila, and in a cotemporary journal, a remarkable instance is mentioned, where the sting of a bee excited vomiting, fainting, sweating, trembling, and great difficulty of breathing. The patient had been stung on the back of the left middle finger, but it caused little pain and no swelling.*

The sting of the scorpion, bee or wasp, requires, according to its violence, internal or external remedies. Generally, emollient anodyne applications to the injured part, are sufficient to allay the irritation, after extracting the sting. The volatile alkali is also a valuable medicine to be administered in severe cases.

POISONOUS FISHES.†

Numerous cases are on record, proving the poisonous nature of various species of fish, and particularly in the West Indies. Dr. Burrows has given us a catalogue of such, which it may be useful to quote. Balistes monoceros, (*old wife.*) Ostracion globellum, (*smooth bottle-fish.*) Tetrodon sceleratus, (*tunny.*) Tetrodon ocellatus, (*blower* or *blazer.*) Muræna major, (*conger eel.*) Coryphœna splendens, (*dolphin.*) Sparus chrysops, (*porgee.*) Coracinus fuscus major, (*grey snapper.*) Coracinus minor, (*hyne.*) Perca major of Browne, (*Esox barracuda, barracuda.*) Perca venenata, (*rock-fish.*) Perca venenosa of Catesby, (*grooper.*) Scomber maximus, (*xiphias of*

* Orfila, vol. 2, p. 414, 415. Edin. Med. and Surg. Jour. vol. 8, p. 130.

† For the purpose of abbreviating my references, and at the same time giving a view of the authorities to which I have referred, I will cite the following papers on fish-poison. *Dr. Chisholm,* in Edinburgh Med. and Surg. Journal, vol. 4, p. 393. *Dr. Burrows,* in London Med. Repository, vol. 3, p. 445. *Dr. E. Thomas,* in Memoirs Med. Soc. of London, vol. 5, p. 94. *Dr. Meyer,* in Barton's Med. and Phys. Journal, vol 1, part 2, p. 43. *Mr. Quarrier,* in London Med. and Phys. Journal, vol. 25, p. 398. *Mariner's* Tonga Islands, vol. 1, p. 309, Lond. ed. *Mr. Anderson,* in Phil. Transactions, vol. 56, p. 544. *Orfila,* vol. 2, p. 417. *Dr. Dickson,* in Annals of Philosophy, vol. 11, p. 462.

Of these, Dr. Chisholm's is by far the most learned and copious, and I recommend it to those who desire an acquaintance with the medical literature of this subject. Dr. Burrows' is equally valuable.

Browne, king-fish.) Scomber thynnus, (*bonetta.*) Another species of scomber, (*cavalloe, horse-eye.*) Scomber cæruleo argenteus nudus, of Browne, (*Spanish mackerel.*) Mormyra of Browne, (*blue parrot-fish.*) Clupea thryssa, (*yellow-billed sprat.*) Cancer astacus, (*sea lobster.*) Cancer ruricolus, (*land crab.*) Mytilus edulis, (*muscle.*)

Of all these, the clupea (*yellow billed sprat*) is the most active and dangerous; and the usual course of symptoms from it is the following: itching over the whole body—violent colic pain—a contraction and pungent heat of the œsophagus—nausea—heat of the skin, and great acceleration of the pulse—giddiness—loss of sight—cold sweats—insensibility, and death. Sometimes the disease is uncommonly rapid—convulsions ensue immediately after swallowing the fish, and death is a speedy consequence. Indeed, whites and negroes have both been known to expire at St. Eustatius, and other of the Leeward islands, with the sprats in their mouths unswallowed.* This, however, is said to be the only fish which produces *immediate* death, even within the tropics.

The grey snapper produces cholera morbus and excruciating pain, with efflorescence, and is apt to leave a weakness of the lower extremities, dimness of sight, and dulness of hearing.

These are also the ordinary results, with, however, some variety, that are experienced from the use of the various kinds enumerated in the preceding catalogue. The contraction and heat of the œsophagus does not occur in some cases, but in its place there is an excessive heat of the mouth and tongue. Miliary eruption, or an efflorescence over the whole body, is also very common.†

The cause of this poison has been the subject of much ingenious research. Dr. Chisholm inclined to the idea, that it was owing to the fish feeding on copper banks. He would seem, however, to have aban-

* Chisholm, p. 395. † Thomas.

doned this, as on chemical examination, a portion of the argillaceous stone of Antigua was found not to contain any; but a precipitate was obtained, possessing the qualities of sulphate of barytes.*

Dr. Burrows has investigated this question with great ability. He is of opinion that the poison does not exist in the skin, or in the stomach and intestinal canal, or in the liver and gall-bladder exclusively, although there is no doubt that persons have been poisoned from eating these various parts. *It pervades the whole substance of the fish*, and this is abundantly proved by the statements of Dr. Chisholm, and the numerous authorities adduced by him. As to its origin, he discusses the cupreous theory of Dr. Chisholm, and shows the great improbability of the metal being held in solution in the sea-water. The fact also that land-crabs occasionally produce similar symptoms, is further urged against this opinion. The idea that other substances taken as food by fish, may be the cause of their poisonous nature, is shown to be unfounded. He concludes with advancing and establishing the belief, that a morbid change takes place in the system of the fish. And this is particularly to be expected in those taken from the tropical seas, as they are immediately exposed to a high temperature, and putrefaction must commence with the extinction of life, and proceed with intense rapidity.†

* London Med. Repository, vol. 5, p. 13.

† Burrows. I add the following, as it contains the observations of an acute and learned observer, and at the same time is, I believe, the latest notice we have on the subject.

"Jan. 18, 1819. A paper was read by Dr. Ferguson, before the Royal Society of Edinburgh, "On the poisonous fishes of the Caribbee islands."

The author endeavoured to prove, that in all the larger fishes of prey, the poisonous quality was a rare and accidental occurrence, and that it was found to be present only at certain seasons of the year in one or two of the smaller species of fish, more particularly in the yellow-billed sprat, (the Sardine dorè of the French, and Clupea thryssa of naturalists.) From whence he inferred that the larger voracious fishes, such as the baracosta, (Perca major of naturalists,) &c. became poisonous only at the times they had recently been preying upon the smaller poisonous prey. The notion of their being made poisonous from being found in copper banks, or their eating the stinging blubbers, (the medusæ and holothuriæ,) was refuted. In

Treatment. An emetic, (of sulphate of zinc) or cathartic should be immediately administered, according to the time that has elapsed since the ingestion of the poisonous substance. If, however, the spontaneous vomiting or purging be very great, it may sometimes be necessary to check it by anodynes. These are also proper when spasms supervene. And for the sequelæ, Dr. Chisholm advises a solution of alkalies in water. Sugar, containing a few drops of sulphuric ether, has also been recommended.

Muscles sometimes produce symptoms very analogous to those just related, and death has occasionally been the consequence in weak females and in children. Violent oppression and agony, swelling of the face, a scarlet efflorescence over the body, insatiable thirst, tormina and vomiting are the usual effects; and in fatal cases, coldness of the extremities, low

regard to tests, it was shown that none could be depended upon; that nothing whatever could be discovered from inspection of the fish; that the boasted test of boiling a piece of silver with the suspected fish, proved nothing, whatever might be its actual quality; that so far from there being any marks of disease in the viscera, or other parts of poisonous fishes, they were found to be in the best season, and of the highest quality, in all respects.

The poison of the yellow-billed sprat was supposed to be inherent in the animal at certain seasons of the year, and not occasioned by its being fed upon any undiscovered local marine poison, from the circumstance of the other smaller fishes that were found in the same place, never partaking of the same poisonous nature, and from the poison of the fish being more potent and deadly than any known or even supposable article of food could be likely to communicate.

With respect to remedies or antidotes, the efficacy of sugar was alone established as deserving of credit. Wines, spirits, and the condiments used at table, were believed to have obtained occasional credit, only from being used in such slight cases of the poison as would likely have passed away without any remedy. As a precaution in all cases of suspicious fish of the larger species, the cleaning them out as soon as caught, was recommended as a useful and proper one, to prevent the carcase being farther tainted by the lodgement of any poisonous matter (such as that of the yellow-billed sprat) recently swallowed; though it was shown at the same time, that the doing so, and even salting the fish afterwards, could not in any instance do away with the poisonous impregnation so communicated to these voracious creatures, whose powers of assimilation, from the shortness of the intestines and great size of the liver, must be supposed to be infinitely quicker than what takes place among terrestrial animals. It was useful also in a more humble way, by furnishing the material of the only criterion hitherto discovered for detecting the poison, which was shown to be that of giving a portion of the liver or offal to some inferior animal, such as a cat, a duck, or a pig, and ascertaining its effects upon them, before making use of the fish." Edinburgh Phil. Journal, vol. 1, p. 194.

and quick pulse, hiccup, delirium and occasional coma.*

In a case which Foderè examined after death, he found the stomach and intestines slightly inflamed.†

The *oyster*, *lobster*, *crab* and *mackerel* of our New-York market, have each occasionally produced poisonous effects, although I know of no case of death from them.‡ Some years since a quantity of oysters arrived in the month of September at Dunkirk, from Normandy. They were extensively purchased and eaten, and colic, diarrhœa and cholera morbus immediately prevailed to a great extent. It was supposed that the oysters were the cause, and Dr. Zandyck was commissioned to enquire into the subject. He found that many of these animals, contained water which left a slimy deposit, and had a decidedly brackish taste, and he suggested that the mischief might be owing to the weakness and languor of the oyster, which had not sufficiently animalized the contained sea-water.‖

The treatment in all these cases must be similar to that already advised as to poisonous fishes generally.

Ornithorynchus paradoxus. It has lately been discovered that the spur of this extraordinary animal, is hollow and connected with a cyst, through which a poisonous fluid is injected into the wound which the animal makes. It causes inflammation and swelling, but does not prove fatal. In one case the arm swelled, the jaw became clenched, and the individual exhibited all the symptoms of persons bitten by snakes. They yielded to the external application of oil, and the internal use of ammonia, but he did not recover the use of his arm for a month.§ The tube is very

* See two fatal cases from eating muscles, by Dr. Burrows, in London Med. Rep. vol. 3, p. 445. Instances are also related in Orfila, vol. 2, p. 419, and Fodere, vol. 4, p. 85.

† Vol. 4, p. 85.

‡ A case of poisonous effects from a crab, supervening within fifteen minutes after eating it, is mentioned in the New-York Med. Rep. vol. 12, p. 189.

‖ London Med. Rep. vol. 13, p. 58.

§ Annals of Philosophy, vol. 9, p. 325.

minute and so small indeed, that it will not admit a horse hair.*

As to the venomous nature of the *Toad*, various and contradictory opinions have existed. It is doubted at the present day, though formerly it was believed. King John of England, is supposed to have been poisoned by a drink in which matter from a living toad had been infused. Pelletier has analyzed the venom of the common toad, and states it to consist of an acid —a very bitter and even caustic fat matter, and an animal matter having some analogy to gelatine.† No experiments however, appear to have been made with it.

The *Pheasant* of this state and Pennsylvania, (or *Partridge*, as it is sometimes styled,) is deemed poisonous during the winter and spring, and the cause assigned for it, is its feeding on the buds of the laurel, (Kalmia latifolia,) which is one of the few shrubs which preserves its verdure throughout the cold season. The facts that we have on this subject are not numerous, but the impression is notwithstanding a general and probably a safe one. Dr. Mease has published several cases, which occurred in 1791 and 1792, in Philadelphia, where individuals dining on pheasants solely, were in a few hours after, seized with giddiness, violent flushings of heat and cold, sickness at stomach, and repeated vomiting. These symptoms were soon succeeded by delirium, weak pulse and extreme debility, while some cases were marked by the preservation of the senses, but a total inability to articulate. They were generally relieved by emetics, diluents and mild stimulants. One case of death ensued, but there were so many causes combining, that it would be improper to ascribe it to the food alone.‡

* Edinburgh Phil. Journ. vol. 6, p. 396. See also, Blainville on the spur, Annals, vol. 10, p. 112.

† London Med. Rep. vol. 9, p. 168. A case somewhat similar to the one mentioned in the text, is contained in Valentini's Pandects, vol. 1, p. 554. *De diarrhœa lethali a talpa (mole) potu ordinario injecta.* The answer of the Medical Faculty of Giessen, discountenancing this idea, and attributing it to horror, is also given.

‡ Mease, in New-York Med. Repository, vol. 1, p. 153. Barton, in Amer-

In a case that occurred to Dr. Drake, also in the winter, vertigo, deadly sickness at the stomach, with extreme languor and exhaustion suddenly attacked the patient. The pupils were dilated, no pulse was present in the arms or temple, and excruciating pain in the stomach, with a disposition to vomit next supervened. An emetic somewhat relieved these, but tenesmus and griping remained for some time, and he very gradually recovered.*

Poisonous Honey. It has long been known that honey is occasionally poisonous. Many of the ancient writers contain facts on this subject, and in particular, a number of the Greek soldiers during the retreat of the ten thousand, are said to have been violently affected by some they had eaten near Trebisond.† I will only notice at this time, the effects that have been produced in our own country, and their probable causes.

Dr. Barton, in the paper already noticed, states that a party of adventurers, removed some hives of bees from Pennsylvania to New-Jersey, in the hope that the savannahs of the latter country might be favourable to the increase of these animals, and consequently to the making of honey. They accordingly placed them in the above situations, and where the kalmia was the principal flowering shrub. The bees increased prodigiously, and their enterprize appeared successful; but it was soon found that every one who ate of the honey, became intoxicated to a high degree. It was then made into metheglin, but with a similar effect on those who partook of it.

The usual symptoms are a dimness of sight, or vertigo, succeeded by a delirium, which is sometimes

ican Philosophical Transactions, vol. 5, p. 60. The opinion has been long entertained, that the food of animals may become poisonous from feeding on noxious substances. A number of authors are quoted to this effect in Schlegel, vol. 3, p. 134, and among other remarks, it is stated that birds feeding on darnel have proved noxious.

* New-York Med. Repository, vol. 21, p. 460.

† On the knowledge of the ancients concerning poisonous honey, see Dr. B. S. Barton's paper, in the American Phil. Transactions, vol. 5, p. 65 to 68, and Foderè, vol. 4, p. 290.

mild and pleasant and sometimes ferocious, ebriety, pain in the stomach and intestines, convulsions, profuse perspiration, foaming at the mouth, vomiting and purging, and in a few instances, death. Sometimes vomiting is among the earliest symptoms, and in that case, the patient is readily relieved, although a temporary weakness of the limbs is not an uncommon result.*

Dr. Hosack has recorded two cases, in which this substance produced violent vomiting, cold extremities and a livid appearance of the countenance. The pulse was reduced to about twenty in a minute. The spontaneous vomiting, however, being followed by a dose of castor oil, together with the application of fomentations, relieved the sufferers. In these instances, the honey was of a dark reddish colour, and a thicker consistence than is usually sold in the market.†

From the facts mentioned above, Dr. Barton is of opinion, that the poisonous nature of the honey is owing to the bees feeding on venomous plants—as the various species of kalmia, the andromeda mariana, which is destructive to sheep; the rhododendron; the azalea nudiflora, and the datura. He recommends that every fœtid or poisonous vegetable should be removed from the habitations of these animals.

Besides the poisons now considered, there are others enumerated by systematic writers, which I defer noticing, until I commence the investigation of MEDICAL POLICE. Of this description are *poisonous animals, used as food*, as oxen, sheep, &c. in whom the fluids have been depraved by disease, and *rabies* (hydrophobia.) I shall conclude this chapter with a few remarks on the *dangers of dissection*.

The accidents to which anatomists are exposed in the prosecution of their studies, are divided by Baron Percy into two classes—those resulting from the putrid gases extricated from the dead animal matters

* Barton ut antea, vol. 5, p. 52.
† Hosack's Med. and Phil. Reg. vol. 3, p. 390.

and acting on the system generally, and those from inoculation of a septic principle, in wounds. I propose noticing the second only.

Fortunately, it is not a frequent occurrence, but the instances that are recorded are marked by a train of symptoms peculiarly malignant, and often suddenly fatal. Dr. Chambon pricked his middle finger with the sphænoid bone of a skull, that had been long macerating. He was soon after seized with the most intolerable pain, and inflammatory swelling of the fingers and hands. At another time, from a similar cause, the mental faculties were disordered, the pulse was irregular, and extreme debility was present.

Corvisart, while examining a dead body, pricked his finger. The arm immediately swelled to an enormous size, and it was only by making repeated and deep incisions into the tumefied parts, that Desault preserved his life.* Le Clerc, professor of legal medicine in the school of medicine at Paris, opened the body of an individual who had died of putrid fever. In dissecting, he wounded his fingers. The virus immediately penetrated over the whole system, and he died on the third day after the accident had taken place. On examination, all the viscera were found in a putrid state.†

Cases have also lately occurred in England and in this country. Dr. Pett of Clapton, assisted a medical friend in examining the body of a lady, who died of peritoneal inflammation after child-birth. Twelve hours after, he complained of pain in the middle finger of his right hand, where a slight superficial wound was discovered. This was touched with caustic, and afterwards with strong sulphuric acid, but he did not feel either of the applications. A second application of lunar caustic produced intense pain. This was followed by severe rigor, and the pain spread with increasing agony along the arm. He passed a sleepless night, and in the morning, his fin-

* Percy. New-England Journal, vol. 8, p. 193.
† New-York Med. Rep. vol. 11, p. 433.

ger was white and without sensation, and his countenance alarmingly altered. The arm went on to swell, the superficial absorbents appeared inflamed, the pectoral and axillary region became much affected, the finger put on the appearance of gangrene, and there was high nervous excitement generally. The unfavourable symptoms rapidly increased, and notwithstanding every means that was used, he sunk in 105 hours after the injury. On examination, the chest and abdomen were found healthy, the heart rather large and flabby, and the liver considerably deranged by a chronic affection.*

A valued friend and colleague of mine, during the present summer, nearly lost his life from a similar cause. He punctured his finger with a needle while examining the body of a child. In forty-eight hours afterwards, acute, lancinating pains were felt in the wound, and it assumed a deep purple colour. The arm itself, and the glands of the axilla also became affected, and were exquisitely painful. A general disturbance of the nervous system soon succeeded, and he was only relieved by a strict adherence to the antiphlogistic treatment.

These cases are sufficient to show the danger that sometimes follows from a puncture during dissection. Whether this danger is aggravated by a peculiar condition of the system, is in some degree still undetermined; but it is not improbable that the effects may be exacerbated in cases where there is no previous predisposition to disease, either of a temporary or constitutional nature.†

As to the treatment, but little can be said. Chaussier recommends that every student should keep constantly in his pocket a small phial of muriate of anti-

* Quarterly Journal Foreign Med. and Surg. vol. 5, p. 313.

† There is a very curious fact recorded by Professor Silliman, in his Journal, (vol. 2, p. 168,) on the authority of Dr. Samuel Brown. Dr. B. informed him that he had had patients under his care, who had been bitten in personal combats, and whose *wounds exhibited every symptom of poison*, pertinaciously resisting all the ordinary modes of cure. The saliva and tartar of the teeth, are mentioned as probably the deleterious substances in these cases.

mony, and whenever he wounds himself, immediately cauterize the puncture with it. Percy advises the application of strong nitric acid.

The disease of the system can only be combatted by the same remedies that are generally applicable in cases where the nervous system is severely affected.*

* New-England Journal, vol 8, p. 195.

FINIS.